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A STUDY OF SURVIVALS IN HODGKIN'S DISEASE TREATED RADIOLOGICALLY*

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HODGKIN'S disease has been generally accepted as a most unpredictable disease. The tremendous variety of sites of involvement, clinical symptoms, and pathological pictures combine to produce a tangled mesh of factors which are very confusing. This survey was made in an attempt, first, to untangle a few of the contradictory factors; second, to estimate the efficacy of radiation therapy as administered in the past; and, third, to find out if possible how our treatment methods could be improved.

The present conception of Hodgkin's disease is somewhat clarified by a review of the historical data. The disease was first described by Hodgkin[2] in 1832 in his description of 7 cases of generalized lymphadenopathy and splenomegaly with similar clinical states, 3 of which have later been disproved.

In 1865 Wilks described 15 similar cases, but drew attention to the "remarkable anaemia" found clinically in these cases. He also noted involvement of liver, kidney and lungs.

Greenfield[4] in 1878 made another observation typical of this disease. He noted the increase of fibrous tissue and the presence of multinucleated giant cells.

The frequent presence of eosinophils in the diseased tissue was first observed by Goldmann[3] in 1892.

In 1898 the characteristic giant cells and areas of necrosis were first described in detail by Sternberg.[13]

Four years later Reed[10] made careful studies coordinating the pathological findings with the clinical histories. Her findings were substantiated by a similar survey reported by Simmons[11] in 1903.

The etiology of the disease is still under investigation and to date remains obscure. Reed in 1902 was the first to separate its etiology definitely from that of tuberculosis in spite of its close resemblance to that disease. Pathologically only the sarcomatous type of Hodgkin's disease presents all the characteristics of a malignancy.

The cases included in this survey are all the cases treated between 1924 and 1942 inclusive in the Ontario Institute of Radiotherapy at the Toronto General Hospital under the direction of Dr. G. E. Richards. Only cases whose original pathological

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pictures have been reviewed and verified by Dr. W. L. Robinson, Professor of Pathology, University of Toronto and pathologist to the Toronto General Hospital, have been included, and we are very grateful to him and to his assistant, Dr. McLaren, for their contribution to this survey. It has been a great assistance to me also to have had all the statistical tables checked by Dr. Neil McKinnon, Professor of Biometrics, University of Toronto.

Before beginning the survival comparisons, the factors which predominate in the incidence of Hodgkin's disease are presented in Table I. The incidence ratio for each individual factor is shown opposite.

TABLE I

INCIDENCE OF HODGKIN'S DISEASE

	Ratio
Sex	M:2 F :1
Age	1–20:1 21–40:3 41–60:2 61–80:1
Sites of initial involvement	
neck	6
inguinal	2
axillary	1
mediastinum	1
generalized	1
rare sites	1
Constitutional symptoms	
present as the primary symptom	2
present as a secondary symptom	4
absent	1

The sex incidence M:F::2:1 agrees with findings in the literature. The age ratio is also consistent with many reported figures. It is presented here in double decades but the high incidence in the 20–30 age group has been noted by many observers. Jackson and Parker[5] have pointed out that Hodgkin's sarcoma is exceptional with regard to age incidence since it is practically unknown in the early age groups but is fairly evenly distributed among the older age groups.

It was of interest to find that 50 per cent of the entire group of cases gave a history of having first noted enlargements of one of the cervical lymph nodes. The remaining sites show no marked variance. It is quite possible that the mediastinal group is larger than is shown, since there are up to 1942 some treated cases of suspected Hodgkin's disease of the mediastinum which are still alive. But these have not been included since their diagnosis is necessarily unproved.

Regarding the presence of constitutional symptoms, less than one-third of the total number gave a history of having noticed any symptoms before the development of enlarged nodes, but only 1 out of 7, or 15 per cent, remained free of symptoms both on admission and following initial control of the disease.

Referring again to the sites of initial involvement, Table II presents the actual number of cases in each group. The high frequency of cervical lymph nodes as the initial site of involvement in this series corresponds with the observations of Jackson and Parker.[5] In their survey 33 per cent of 28 cases of Hodgkin's paragranuloma, 72 per cent of 213 cases of Hodgkin's granuloma and 31 per cent of 32 cases of Hodgkin's sarcoma, gave a history of cervical lymph nodes as the initial site of involvement, making an overall incidence of 65 per cent as compared with 50 per cent in the present series.

TABLE II

HODGKIN'S DISEASE, 1924–1942

Sites of Initial Involvement

	Cases
Cervical or supraclavicular nodes	54
Inguinal nodes	17
Axillary nodes	9
Mediastinum	10
Intra-abdominal	4
Unusual or rare sites	10
Origin unknown or generalized	9
Total	113

Between 1924 and 1942 inclusive, a total of 257 cases with a diagnosis of Hodgkin's disease were treated radiologically in our hospital. The overall five year survival of this entire group was 38 per cent. Two groups of cases have been excluded from this survey. The group of 60 cases with no histopathological verification, but having a five year survival of 33 per cent, was first removed. The second group of 84 cases having a five year survival of 33 per cent, was first removed. The second group of 84 cases having a five year survival rate of 22 per cent was excluded by our pathologist from this review chiefly because of incorrect pathological diagnosis and in a few cases because the original slides could not be recovered for verification. There remained 113 pathologically proved and verified cases of Hodgkin's disease for coordinative studies. This final group has a gross overall five year survival of 51 per cent. But very little importance is attached to this figure. As the cases are analyzed according to the various factors which influence the survival rates, the overall survival figure gradually assumes less prominence.

Table III presents the complete picture of the overall survival by the year. The total survival of each case in each year is followed across to its total survival to date. Thus the diagonal line produced by the termination of each year's admissions represents the end of 1947. The first line of totals represents the total number of cases from which the survival rates by the year can be calculated. The second line of totals represents the total number of survivals after one year, etc., up to twenty-one years. The third line of totals represents the percentage survivals by the year, calculated from the two lines above it.

It is noted from this table that the greatest single drop in survivals in any one year is during the first year, when 22 per cent fail to survive. Another 16 per cent fail to live beyond the second year. After the second year, the decline is fairly gradual

TABLE III

HODGKIN'S DISEASE, 1924–1942

Pathological Diagnosis

Survival according to year of admission

Year	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1924	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1928	4	4	4	4	4	4	3	3	1	1												
1929	1	1	1	1	1	1	1	1	1	1	1	1	1	1†								
1930	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1D				
1931	5	4	4	4	4	4	4†	2	2	2	2	2	2	2	2	2	2 A					
1932	4	4	4	3	3	2	2	1	1	1	1	1	1	1	1	1 A						
1933	7	6	5	5	5	5	5†	3	3	3	3	1	1	1	1 A							
1934	10	10	8	7	6	6	6	6	5	4	4	3	3	3 A								
1935	2	1	1	1	1	1	1	1	1	1	1	1	1 A									
1936	8	5	5	5	5	5	4	3	3	3	3	3 A										
1937	11	9	7	7	7	7‡	5	3	2	2	2 A											
1938	7	5	2	2	2	2†	1	1	1†													
1939	10	7	4	3	3	3	3	2	2 A													
1940	11	10	7†	6	4	4	4	4 A														
1941	23†	15	11	11†	9	7	5 A†															
1942	8	5	5	5	5	5†																
Total No. cases	113	113	113	113	113	113	105	82	71	61	54	43	35	33	23	16	12	7	6	5	1	1
No. survivals		88	70	66	61	58	46	32	24	20	19	14	11	10	6	5	4	2	1	1	1	1
Percentage survivals by year		78	62	58	54	51	44	40	34	33	35	32	31	30	26	31	33	—	—	—	—	—

† Untraced and ‡died of extraneous disease

until after the eighth year. From the ninth year of survival on, except for slight fluctuations which are a result of a different total number of cases being used in each calculation, the percentage survival is practically unchanged until the total becomes so small that the calculation is worthless.

Figure 1 demonstrates graphically the progress of the overall survival picture of the survival percentages after eight years all are clearly indicated in this graph.

After completing the overall picture, the first step in the analysis was to group the cases uniformly according to their ultimate survival and to estimate the most common findings in each group The extent of involvement on admission appeared to be the most striking common factor. Thus a

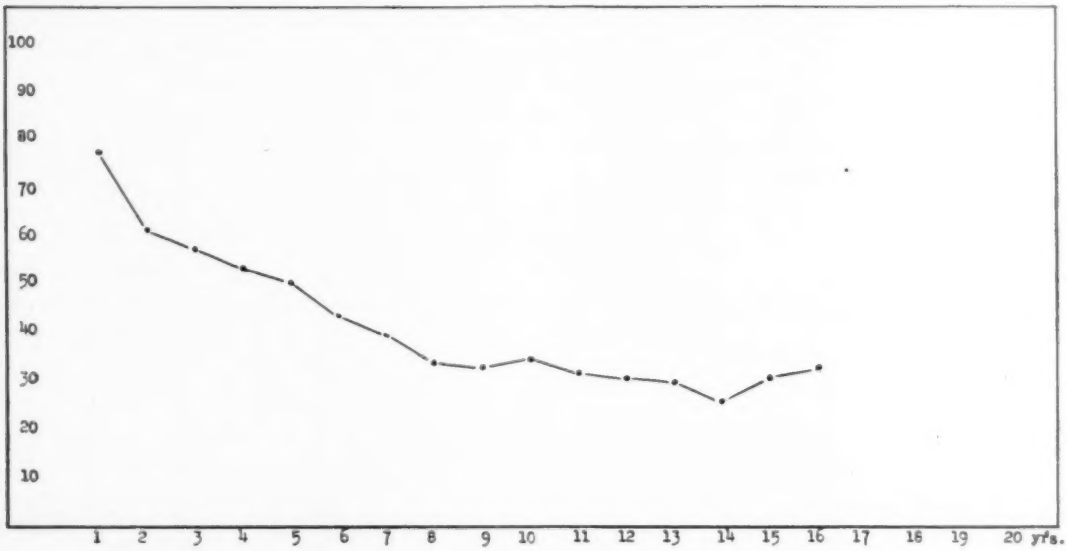

FIG. 1. Hodgkin's disease, 1924–1942. Graph showing percentage survival rates.

accentuating the outstanding observations. The initial sudden drop, the gradual decline from two to eight years, and the levelling temporary classification evolved which also served as a very useful subdivision of cases for comparison with other factors. Table IV presents this working classification according to the amount of involvement on admission.

TABLE IV

HODGKIN'S DISEASE

Classification According to Extent of Involvement on Admission

Stage I	Involvement of a single lymph node region or a single lesion elsewhere in the body
Stage II	Involvement of two or more proximal lymph node regions of either the upper or lower trunk
Stage III	Involvement of two or more lymph node regions of both upper and lower trunk

In the Stage I group of cases, those having only single lymph node regions or single lesions elsewhere in the body involved on admission, the survival rate is consistently high at both the five and the ten year mark. In Stage II the five year survival is high but there is a tremendous drop to the ten year survival. This stage, therefore, fittingly represents truly border line cases. In the Stage III group with multiple involvement on admission the survival rate is consistently poor. There are no ten year survivals in this category. As a matter of

TABLE V

HODGKIN'S DISEASE, 1924–1942

Five and Ten Year Survivals

Stage	1924–1949							1924–1937						
	Total no. cases	At end of 5 years				Gross percentage survivals	Net percentage survivals	Total no. cases	At end of 10 years				Gross percentage survivals	Net percentage survivals
		Alive	Untreated	DED	DD				Alive	Untreated	DED	DD		
I	35	31	2	—	2	88%	94%	19	15	1	0	3	79%	84%
II	32	23	—	—	9	72%	72%	19	4	2	1	12	21%	25%
III	46	4	1	—	41	9%	9%	16	—	—	1	15	0%	0%
Total	113	58	3	—	52	51%	53%	54	19	3	2	30	35%	39%

DED = Died of extraneous disease.
DD = Died of Hodgkin's disease.

interest only, Stage II could be further subdivided into an earlier group with only unilateral involvement of upper or lower trunk, but one would require a larger group of cases to demonstrate this point convincingly.

Table V presents the five and ten year survival percentage for each of these three groups as well as the overall rates. Fortunately there are very few patients who were untraced or who died of extraneous disease, leaving very little difference between the gross and the net survival percentages. The consistently high survival rate in Stage I, 88 per cent at five years and 79 per cent at ten years, is observed. It is of interest to find a difference of only 10 per cent between the five and ten year net survival percentages. The cure rate drops from 72 per cent to twenty-one per cent between five and ten years in Stage II. In Stage III, only 4 cases, or 9 per cent, survived five years and none survived ten.

As will be seen in a later table, the overall five year survival of 51 per cent represents an absolute improvement of 25 per cent and a relative improvement of 100 per cent over any previously reported figure. The ten year survival percentage of 35 per cent is more than four times any reported figure to date. There is a difference of 4 per cent between the gross and the net figures for the overall ten year survival since the risk of losing contact with patients over a period of ten years is fairly high. The 3 untraced cases are most probably well after having been followed for more than five years before being lost, since, if recurrences develop, one nearly always receives some information about the case either directly or indirectly from another center.

TABLE VI

HODGKIN'S DISEASE, 1924–1937

Average and Median Survivals

	Stage I Years	Stage II Years	Stage III Years	Total Years
Average duration on admission	1.5	1.6	1.4	1.5
Median duration on admission	1.1	0.9	1.0	1.0
Average survival since admission	11.3+	7.0+	1.9	7.0+
Median survival since admission	10.5+	6.9+	0.9	6.8+
Average survival since onset	12.8+	8.6+	3.3	8.5+
Median survival since onset	11.6+	7.8+	1.9	7.8+

Table VI demonstrates the average and median survivals of the group of cases from 1924 to 1937. The 1938–1942 cases were excluded in order to get a more correct estimate of the total survivals. From the point of view of statistics the median survival is more correct than the average. The median duration of disease on admission, i.e., 1.0 year was calculated separately to find out the average duration before the patient sought treatment. The median survival since onset in Stage I is 11.6 years+, Stage II is 7.8 years+, Stage III is 1.9 years, resulting in an overall median survival of 7.8 years. The highest median survival so far reported from recent surveys in other centers is 33.8 months as reported by Craver and Slaughter of Memorial Hospital, New York.

In addition to the extent of involvement on admission, there are four other factors which influence the prognosis: the age and sex of the patient, the pathological picture and the presence of constitutional symptoms on first admission for therapy.

Table VII demonstrates the influence of the age of admission on the five year survival rate. The age groups are divided into decades and the number of survivals in each decade per stage is designated. Under the heading of total, the percentage five year survival per decade is tabulated. There are two conclusions of note to be drawn from this table.

TABLE VII

RELATIONSHIP OF AGE GROUP TO FIVE YEAR SURVIVAL IN HODGKIN'S DISEASE

1924–1942

Decades	Stage I		Stage II		Stage III		Total		Regrouping of Decades	
	No. cases	No. alive and well 5 yr.	No. cases	No. alive and well 5 yr.	No. cases	No. alive and well 5 yr.	No. cases	Percentage 5 yr. survival	No. cases	Percentage 5 yr. survivals
1–10	1	1	1	1	1	0	3	66%		
11–20	4	4	4	4	4	0	12	66%		
21–30	11	10	8	8	9	1	28	68%	81	64%
31–40	8	8	4	3	8	0	20	55%		
41–50	4	4	8	6	6	2	18	66%		
51–60	3	2	5	0	11	0	19	11%		
61–70	2	1	2	1	6	1	10	30%	32	19%
71+	2	1	0	0	1	0	3	33%		
Total	35	31	32	23	46	4	113	51%	113	51%

First, by regrouping the decades into similar survival rates, the total number can be divided into two groups. Up to fifty years of age, the five year survival is better than average and beyond fifty years of age it is much below average. Second, taking the stages into consideration, the majority of the five year survivals (excluding 7 isolated cases out of a total of 58) can be blocked off into the left upper section of the table. In this section, which is composed of Stage I up to sixty years of age and Stage II up to fifty years of age, the percentage five year sur-

vival ranges from 66 per cent to 100 per cent which is better than the average survival for any one decade, with the exception of the 21–30 age group. Thus one may conclude that age of admission is an important factor influencing the progress of Hodgkin's disease, but that it could not by itself indicate the prognosis.

Table VIII demonstrates the influence of sex on survival. Epstein[1] reported in 1939 that over one-half of the women survive more than five years, and nearly one-fifth are still alive after ten years, the figures for men being much lower for each group.

According to this survey, the majority of the more advanced cases of Hodgkin's disease are found among the male group of cases. In Stage III, there are 34 males compared with 12 females which represents a greater predominance of males than in the two earlier stages. The disease may tend to be more chronic in females. The overall five year survival percentage is 15 per cent higher in the female group. Although not included in Table VIII, it was found that 50 per cent of the ten year survivals are female. Taking into consideration the fact that only one-third of the cases admitted are female, one can assume that the prognosis is somewhat better in that sex. Statistically, however, these results lie within the range of possible error. Thus this factor can be excluded as an important one but represents a likely trend.

Up to the present the only published reports on comparative survival rates of Hodgkin's disease have been made on the basis of a histopathological classification. The varying stands taken by different pathologists on its histopathological staging makes the comparison of these factors with the clinical factors an extremely difficult one. From this standpoint the results of this comparison may be open to criticism, but the conclusions of prime importance cannot be overlooked. The pathological classification of the typical cases of Hodgkin's disease in this survey, as interpreted by Dr. Robinson, varies only in one respect from that outlined by Jackson and Parker[6]. Jackson and Parker assign the terms paragranuloma, granuloma and sarcoma to the three distinct pathological pictures of Hodgkin's disease. In this survey the terms early, classical and late Hodgkin's have been utilized but the "late" groups include the more advanced pictures of Hodgkin's granuloma as well as Hodgkin's sarcoma. With this slight difference in grouping, the histopathological points of differentiation, as outlined by Jackson and Parker, are practically identical with the criteria employed by our pathologist.

The atypical cases represent those cases

TABLE VIII

HODGKIN'S DISEASE

Influence of Sex on Percentage. Five Year Survival (Gross)

	Totals		Male		Female	
Stage	No. cases	Percentage 5 year survival	No. cases	Percentage 5 year survival	No. cases	Percentage 5 year survival
I	35	88%	22	82%	13	100%
II	32	72%	19	68%	13	77%
III	46	9%	34	12%	12	0%
Total	113	51%	75	47%	38	61%
		Incidence ratio M : F : : 2 : 1				

quite probably at a transition phase, at which stage it is very difficult and sometimes impossible to "pigeon-hole" the findings into the proper category until a further biopsy is obtained.

survive five years were both late cases of typical Hodgkin's disease (the other 2 remain untraced). The 3 additional cases in the clinical Stage I which failed to survive ten years were pathologically, 1 early, 1

TABLE IX

HODGKIN'S DISEASE, 1924–1942

Pathological picture versus extent of lymph node involvement
Distribution of cases and percentage five year survivals

Stage Clinical Path.	Early		Classical		Late		Atypical		Total		Percentage 5 Yr. Surv.
	No. cases—	5 yr. surv.	No. cases—	5 yr. surv.	No. cases—	5 yr. surv.	No. cases—	5 yr. surv.	No. cases—	5 yr. surv.	
I	10	9	13	11	6	6	6	5	35	31	88%
II	5	6	19	14	7	4	0	0	32	23	72%
III	4	1	17	2	11	1	14	0	46	4	9%
Total No. cases	20	15	49	27	24		20	5	113	48	
Percentage 5 year survival	75%		57%		50%		25%				51%

Note: Under heading of "Late" appear 2 cases of Hodgkin's sarcoma in Stage II—1 surviving 5 years, and 3 cases of Hodgkin's sarcoma in Stage III—1 surviving 5 years.

Table IX shows the influence of the histopathological picture on the survival rate. As is shown in this table, all the pathological classifications appear in each clinical stage according to extent of involvement, with the exception of the atypical group which is absent in the borderline group and tends to be either very early or very late Hodgkin's disease. But the number of cases of each microscopic picture in each clinical group varies directly with the majorities one would expect to find. In the early group of typical pathological pictures there are more cases in Stage II than in the total of the other two stages and very few in Stage III. In the classical group which represents the largest group the numbers are fairly evenly divided. In the late group the numbers rise with the advancing stage; and there are more than twice as many atypical cases in Stage III as in Stage I.

It is interesting to discover that the 2 cases of the clinical Stage I which failed to

classical and 1 late. Also the 4 cases in clinical Stage III which survived five years were fairly evenly distributed among the three pathological stages, 1 being early, 2 classical, and 1 late.

The five year survivals are also consistent with the pathological stage, 75 per cent five year survival in the early group down to 25 per cent in the atypical group. But the percentage survivals are not sufficiently decisive to be used alone as a prognosis guide, as compared with the percentage survivals according to the extent of involvement on admission, as shown in the last column.

As a matter of interest the cases surviving more than fifteen years from onset were tabulated separately in Table X. It was discovered that two-thirds of these 9 cases had a classical pathological picture, 2 cases atypical, and only 1 early. Their survivals from onset to date range from fifteen to thirty-one years. The survivals of these 9

specified cases do not appear as such in the survival tables presented, since all the survivals quoted in this survey with the exception of Table x are based on the survival since admission for radiotherapy.

From these tables it is concluded that the pathological picture is a very necessary, indeed the only proof of the diagnosis, but in establishing the prognosis it acts as a valuable aid, but is not as conclusive as the clinical factors.

Table xi demonstrates the influence of the presence of constitutional symptoms on admission on the prognosis. This is the only contributing factor which seemed to go hand in hand with the extent of involvement on admission, therefore the percentage ten year survivals were also calculated in order to verify the correctness of the impression. Nearly all the Stage i cases had no general symptoms of loss of weight, lack of energy, fluctuating fever, pruritus, etc. These symptoms, however, were present in the majority of the borderline and particularly the late cases. The chief argument against using this factor alone as a basis for predicting the progress is, as is shown in the five and ten year survivals, the fact that although it is a fairly good estimate of the early group and includes a few more cases than Stage i, of the clinical classification, it does not indicate a borderline group which should have a good early survival but a poor ultimate survival. But this table was utilized to make up the final clinical classification which will be shown in Table xii. Referring again to the Stage i cases of this survey, both of the cases in this stage which did not survive five years had constitutional symptoms on admission. Thus, by applying this factor to the clinical classification, the net five year survival of Stage i becomes 100 per cent.

Table xii, as stated above, shows the

Table X

HODGKIN'S DISEASE

Nine Cases Surviving More Than Fifteen Years from Onset

Mrs. D. D.	Classical	15 years +
Mr. R. B.	Classical, moderately active	21 years
Mrs. V. M.	Classical	20 years
Mr. H. B.	Classical	15 years +
Mrs. G. G.	Classical	22 years +
Mrs. E. L.	Classical	17 years +
Mrs. G.	Atypical	31 years
Mrs. M. K.	Atypical	23 years
Mrs. I. S.	Early but typical	17 years +

Table XI

HODGKIN'S DISEASE, 1924–1942

Constitutional Symptoms on Admission Versus Extent of Lymph Node Involvement

Stage Lymph Node Involv. Gen. Symp.	No. Const. Symp. 5 Yr. Survival	Const. Symptoms + but not First Complaint	Const. Symptoms First Complaint	Total No. Cases	Percentage 5 Year Survival	Percentage 10 Year Survival 1924–1937
I	28	5	2	35	88%	79%
II	9	10	13	32	72%	21%
III	3	21	22	46	9%	0%
Total No. cases	40	36	37	113		
Percentage 5 year survival	85%	36%	30%		51%	
Percentage 10 year survival (1924–37)	65%	8%	11%			35%

TABLE XII

CLINICAL CLASSIFICATION OF HODGKIN'S DISEASE

Stage I	Involvement of only one lymph node region or a single lesion elsewhere, with no constitutional symptoms
Stage II	Involvement of two or more proximal lymph node regions confined to either upper or lower trunk, with or without constitutional symptoms
Stage III	Involvement of multiple lymph node regions with or without constitutional symptoms or acute Hodgkin's disease with no obvious lymphatic involvement

clinical classification which was planned to include the most salient clinical factors influencing the prognosis in Hodgkin's disease without complicating it by adding the lesser but very important contributory influences. To make this classification complete, to Stage III was added the small group of acute cases with no obvious lymphatic involvement but which runs a very rapid course and is not influenced by irradiation. These cases are rarely referred for a trial of radiotherapy.

The last step in this analysis was to attempt to estimate the value of the irradiation methods which have been practised in the past. In general, two methods have been adopted. Less than 50 per cent of the cases have received intensive irradiation to the involved nodes only. The larger group received one or two and occasionally three prophylactic series of irradiation to all the more commonly involved lymph node regions as well as more intensive irradiation to the involved nodes. As shown in Table XIII, there is no difference in the survival percentages of these two methods of treatment in Stage I, but there is a slight difference in Stages II and III. The ultimate result shows an improvement of 17 per cent in the five year survival of the cases receiving prophylactic irradiation. But taking into consideration the small number of survivals in the late group, as compared with the large number in the early groups where there is less improvement, this overall 17 per cent imporvement is not statistically significant. The chief objection to treating uninvolved regions raised by Merner[9] of Boston in his 1947 report on a similar survey was that since Hodgkin's disease is so unpredictable, the recurrences are apt to occur anywhere in the body. In this series of cases, with few exceptions, the first extension has occurred in one of the most proximal lymph node regions. Therefore, we believe that prophylactic irradiation is indicated especially to the neighboring lymphatic areas.

At the present time in our Institution the moderately and the extensively involved

TABLE XIII

INFLUENCE OF PROPHYLACTIC IRRADIATION ON FIVE YEAR SURVIVAL OF PATIENTS WITH HODGKIN'S DISEASE, 1924–1942

Group	Stage I		Stage II		Stage III		Total	
	No. cases	Percentage 5 year survival	No. cases	Percentage 5 year survival	No. cases	Percentage 5 year survival	No. cases	Percentage 5 year survival
All cases including rare cases	35	88%	32	72%	46	9%	113	51%
A. Irradiation to involved nodes plus proximal nodes	15	93%	24	75%	24	17%	63	57%
B. Irradiation to involved nodes only	12	92%	8	62%	20	0%	40	40%
Improvement in cure rate by prophylactic irradiation				13%		17%		17%

The 10 cases of rare sites of involvement on admission excluded from comparative figures.

lymphatic regions are irradiated using the 400 kv. apparatus (0.6 Sn filter, 100 cm. skin target distance, 5 ma., 4.5 mm. Cu half-value layer). Arranging the portals to suit the involvement, the total dosage to each region treated in this manner varies from 1,800 r to 5,000 r, depending on the extent of involvement and the resistance to irradiation. Using the 200 kv. unit (0.2 Sn, 50 cm. skin target distance, 5 ma., 1.2 mm. Cu half-value layer) the uninvolved peripheral lymphatic regions when included in the course of treatment each receive a total of 400 r to 800 r, depending on the age of the patients and their tolerance of irradiation. In addition, the mediastinal nodes and deep lumbar nodes each are irradiated through two anterior and two posterior portals (400 r to each portal). The white blood cell count is checked at intervals, particularly while treating the mediastinum and abdomen in order to avoid a leukopenia.

Single recurrences receive irradiation as early as possible, using either the 200 kv. unit, 400 kv. unit or teleradium, depending on the extent and position of the lesion. If the recurrence resists irradiation on one unit, treatment is attempted on another apparatus, since the response to therapy varies considerably.

It has also been observed that extensive irradiation to one lymphatic region results in considerable reduction in the size of other grossly involved nodes. Therefore, one cannot anticipate at the beginning of a course of radiotherapy to a patient the number of treatments or the total dosage necessary to bring about a satisfactory regression of all the involved lymphatic nodes.

According to Figure 1 prophylactic irradiation of uninvolved lymphatic regions seems to be beneficial but not necessary. In view of the variety of responses the total amount of radiation received regardless of the site may be more significant.

TABLE XIV

HODGKIN'S DISEASE

Survival Rates Published (to Date)

Author	Place	Date of Publication	No. Cases in Survey	Percentage 5 Year Survivals	Percentage 10 Year Survivals	Average Survival
Krumbhaar	University of Pennsylvania	1939		15%	6%	
Slaughter and Craver	Memorial Hospital, New York	1942	265	17.7%	3.4%	33.8 months
Medinger and Craver	Memorial Hospital, New York	1942	94 (Total body irradiation)	24%		
Merner and Stenstrom	Minneapolis	1947	185	21%	8%	33.1 months

Table XIV shows the survival rates of Hodgkin's disease as reported from various other treatment centers [7,8,9,12] recently. In the light of the evidence presented showing the predominating factors influencing the prognosis in Hodgkin's disease it is probably very unfair to compare the results of roentgen therapy of different radiotherapy centers without knowing the number of cases in each clinical stage of the other centers. The overall survival rate would necessarily vary considerably according to the number of cases especially of Stages I and II presented for treatment in each center. But one cannot overemphasize the optimistic prognosis in the early clinical stages regardless of the histopathology present.

The last table, Table XV, is an attempt

to follow the progress of the five year survivals of the 1924 to 1937 cases, in order to estimate the expected picture at ten years of a given group of five year survivors.

The center group represents the category of all the cases at the end of five years. Of 54 cases, 37 are alive at the end of five years. Twenty-five of these are perfectly well, and have had no recurrences since the first year following admission. The other 12 are classed as "alive with disease" but only the minority of these are incapacitated. A.W.D. here means that they have had recent recurrences and the disease seems to be progressing.

Following the 12 A.W.D. group into the ten year survival one-half (6) are still A.W.D. having had repeated recurrences which were each controlled by irradiation, but the disease is still progressing. The other 6 cases are dead at ten years.

Following the 25 cases "alive and well" at five years into ten years, 3 of them have become untraced but are believed to be well and 2 have died of extraneous disease. Forty per cent, or 10 cases remain in the A. & W. group and have been followed periodically. Another 40 per cent, or 10 cases of the original 25, have developed recurrences, 7 having died, and 3 still living, i.e. A.W.D.

Thus of the 19 ten year survivors, from the original 37 five year survivals, a little more than one-half, 10 cases, have had no recurrences since the first year of admission and the disease is progressing slowly in the other 9 cases. Also the 10 cases which have been free of disease since the first year of admission represent 19 per cent of the entire group followed for ten years. This figure, therefore, could be referred to as the absolute ten year cure rate. The other 9 cases have already followed the customary but delayed course of Hodgkin's disease. Contrary to what one would expect, 8 of these 10 cases free of disease after ten years, had, on admission, a histopathological picture of classical Hodgkin's granuloma and only the remaining 2 cases were of the early or paragranuloma group.

It is to be hoped that recent therapeutic measures for this disease, which I have not attempted to discuss in this paper, will further improve its prognosis. But in the light of present knowledge, the diagnosis of Hodgkin's disease should not be regarded with despair and the patient treated as incurable, until the case in question has been

TABLE XV

HODGKIN'S DISEASE

Progress of 54 Cases, 1924–1937

	10 years	5 years	10 years	
Unt. or DED	5	0	5	Unt. or DED
A. & W.	10	25	10	A. & W.
A. W. D.	9 (6)	12	9	A. W. D.
D D	30	17	30	D D
Total	54	54	54	Total

(5) (10) (3) (6) (7)

A. & W.—No recurrence+recurrences within first year controlled—none since.
A.W.D.—Recent recurrences or succession of recurrences throughout life.

thoroughly analyzed from every angle. Then, if a single ray of hope emerges from this analysis, the immediate treatment of the individual involved is a challenge to the combined efforts of the radiotherapist, the physician and the surgeon.

SUMMARY AND CONCLUSIONS

1. The overall five year survival rate of 51 per cent and the ten year survival rate of 35 per cent in this series is considerably better than any other survival rate reported in the literature to date.

2. The most important single factor influencing the progress and ultimate survival of a case of Hodgkin's disease is the extent of involvement on institution of treatment.

3. The second most important factor influencing the prognosis is the presence of constitutional symptoms on admission.

4. The histopathological picture is the only proof of diagnosis and is a factor in estimating the severity of the disease.

5. The early age groups tend to respond to therapy better than the later age groups.

6. Hodgkin's disease of the female sex tends to run a more chronic course which enhances the survival rate as compared with the male sex.

7. A clinical classification has been suggested.

8. Intensive irradiation of involved lymph nodes combined with precautionary treatment to the proximal nodes seems to have improved the survival rates in this group of cases.

One concludes from this survey that the chief factors in the control of Hodgkin's disease are:

1. Early diagnosis and a more optimistic attitude toward prognosis in early cases.
2. Proper classification.
3. Early institution of therapy.
4. Moderately intensive treatment to the hopeful cases.
5. Frequent follow-up.
6. Institution of radiation therapy to recurrences as early as possible.

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TREATMENT OF METASTASES FROM CANCER OF THE BREAST*

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NEW YORK, NEW YORK

With Section on HORMONAL THERAPY OF BREAST CANCER

By JULIAN B. HERRMANN, M.D.
NEW YORK, NEW YORK

FOR reasons which can be attributed to the patient, the physician, and to the nature of the disease, many patients with cancer of the breast unfortunately will not be cured. The management of those individuals, who sooner or later develop recurrences or metastases, is a difficult problem. They unquestionably are better treated by physicians who are experienced in the therapy of advanced cancer. The ambulant patient in good general condition, with a recurrence or metastasis still localized to one region or system, is a simpler problem of management. The treatment of the bedridden hospitalized patient poses many difficulties. These are best answered by a tumor group, such as we have at the Montefiore Hospital for Chronic Diseases, consisting of surgeons, radiotherapists, internists and pathologists, all experienced in chronic cancer. The problems associated with the particular patient are discussed, and then only is treatment prescribed. In advanced cancer of the breast, the most perplexing questions are often those concerned with the general measures to be undertaken to improve the patient's general condition and any medical complications, such as cachexia, anemia, vomiting, dehydration, etc. When the patient is admitted in a moribund condition, it does not mean that she should be permitted to die. Some of these individuals can be salvaged and made comfortable for months, with proper medical care. The following case is an example:

Case 1. R. B., aged thirty-nine (Montefiore Hospital No. 44781). This patient, with extensive skeletal and pulmonary metastases from a cancer of the right breast, was admitted to the Montefiore Hospital in a moribund condition. Further neglect would have meant death in a few days since she was anemic, markedly emaciated and cachectic. However, she was placed on a high caloric diet plus therapeutic vitamins, iron, and codeine for sedation. Because of the profound anemia, a 1,000 cc. blood transfusion was given over several days. Within two weeks, clinical improvement was apparent. Pain decreased in severity and frequency, and she began to gain weight. After three weeks, she was sufficiently improved so that radiotherapy could be started. At the conclusion of this treatment, she was comfortable and could get about with ease. A few months later, pain recurred, and since it was not relieved by conservative measures, prefrontal lobotomy was performed. For two months, pain and other complaints remained unchanged. Despite the fact that she was running a retrogressive course, she became generally happy and comfortable. She finally died thirteen months following her admission to this hospital.

Once a patient with metastases from carcinoma of the breast is hospitalized, her general condition permitting, she is referred for whatever local treatment may be necessary to halt the spread of the disease. For discussion of these measures, the material has been divided according to anatomical sites of involvement as follows: (1) skin; (2) regional lymph nodes; (3) skeleton; (4) intrathoracic region; (5) intra-abdominal region; (6) central nervous system. Special attention will be paid to castration and hormone therapy.

* From the Department of Radiotherapy and Division of Neoplastic Diseases of the Montefiore Hospital for Chronic Diseases, New York. Presented at the Thirtieth Annual Meeting, American Radium Society, Chicago, Ill., June 20–22, 1948.

SKIN

There was 41.6 per cent local recurrence in the operative field in 125 patients who had had a radical mastectomy for malignancy, and who were followed to their death from metastatic disease. We did not include spread to the axilla or the supraclavicular region in this tabulation. Most of these patients had had axillary invasion at the time of operation.

Richards[7,8] gives 15 per cent as the average frequency of local recurrence observed in the ordinary follow-up of several large operative series where the best operative procedures had been followed. Our much higher percentage for patients followed to death calls attention again to the frequent association of local recurrence and dissemination to other systems, as well as the difficulty in sterilizing the operative field of tumor cells by even the most extensive operative procedures. It is believed that local recurrence follows incomplete operative or disease persisting in the deep fascial plexus, spreading by lymphatic emboli or by permeation. Dudgeon and Barrett,[2] who made cross sections of the entire breast and adjacent tissues, after its operative removal, demonstrated tumor cells in the tissue spaces remote from the local tumor, casting further light on the manner of local spread.

The main types of local recurrence are classified as follows:

1. Single nodules or several nodules seen lying close together. There may be some reddening of the overlying skin. With progression, the skin is invaded and shows retraction, ulceration and crusting. Adjacent nodules coalesce.

2. Crops of nodules with apparently normal intervening tissue may appear over a wide area, such as the entire chest wall, the upper abdomen, etc.

3. Carcinoma en cuirasse, a picture of diffuse nodular spread in combination with intense fibrosis. The chest wall becomes constricted and indurated, with a brawny, irregular skin. Ulceration may be present.

4. A large mass growing exuberantly outward from the chest wall. There are usually inflammatory changes in the overlying skin and central necrosis.

Radiotherapy is usually effective in the eradication or palliation of the local disease, depending on its extent. Well localized recurrences of moderate extent are intensively irradiated to achieve complete control. The treated field should extend well beyond any suspicion of infiltration, and a total of 3,000 to 5,000 roentgens is given in divided doses, using medium or low voltage therapy. An extensive area is best divided into several fields treated alternately. If excision of the local recurrence is resorted to, the area is watched and irradiation given, should it recur again. A large bulky recurrence is irradiated through several fields in order to crossfire the lesion. The dosage is fractionated, using deep roentgen therapy and giving 2,500 to 3,000 r at the skin per field. A tangential beam is used where possible, to avoid damage to the lungs. In the presence of local necrosis or marked inflammatory changes, the initial doses are small in order to control these features. The local application of allantoin ointment, zinc peroxide as described by Meleney,[6] penicillin ointment or a solution of brilliant green, 1 per cent in 50 per cent alcohol, are all useful in limiting local infection and necrosis.

Case II. A. P., aged forty-seven (Montefiore Hospital No. 41494). This patient was admitted in June, 1946. She had had a partial excision of the left breast in 1941 for carcinoma, followed by partial excisions of recurrences on eight occasions. At the time of admission, she presented a huge necrotic mass filling the axilla and infiltrating the adjacent areas (Fig. 1*A*). There were frequent local hemorrhages. The arm was massively edematous. Following intensive therapy, there was striking regression of the mass and the lymphedema (Fig. 1*B*). This effect, unfortunately, was not long maintained, as it was impossible to sterilize the field.

Regional Lymph Nodes. Axillary Spread. While spread at this site is usually obvious, at times it may be difficult to diagnose. For example, a vague thickening may be palpated in the axilla, which, on further ob-

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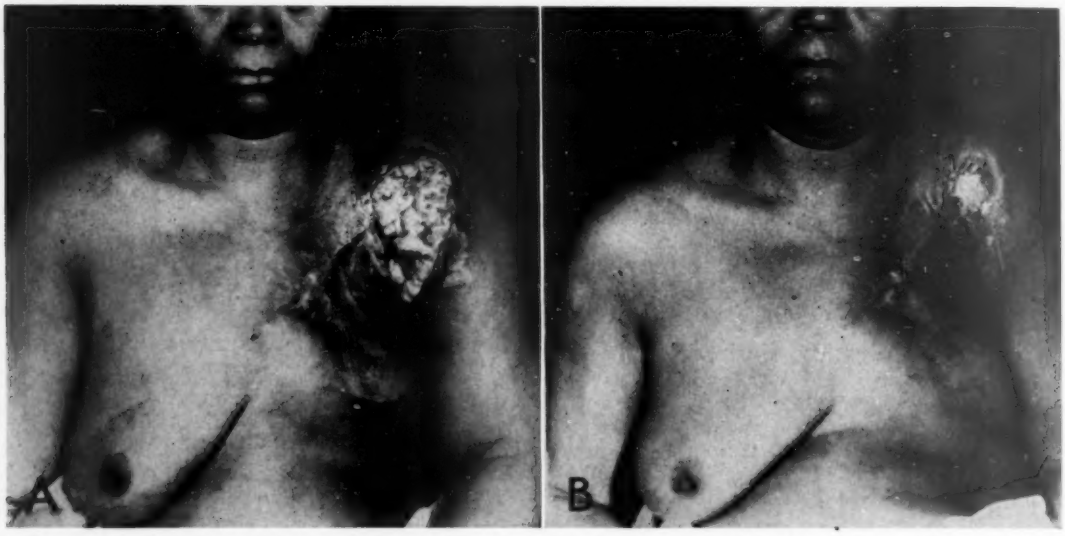

FIG. 1. Case II. (*A*) Huge necrotic mass filling the left axilla and infiltrating the adjacent tissues. Massive edema of the left arm. (*B*) Striking regression of the mass and the lymphedema following intensive radiotherapy.

servation, may regress spontaneously, suggesting that it is inflammatory. This is not uncommonly seen in the early months postoperatively. Should it, however, go on to skin retraction or discoloration, biopsy will be necessary to determine malignant invasion. No therapy should be administered until this confirmation is obtained. Axillary spread may produce lymphedema of the arm with marked disability and pain. Lymphedema can also occur as a sequel of operation, or after intensive postoperative irradiation that has visibly damaged the axillary tissues. The occurrence of progressive edema can be established by careful measurement of the circumference of the upper arm, taken at a fixed distance from the olecranon, and repeated at intervals. When the edema is a sequel of operation or irradiation, further irradiation will only aggravate it. No therapy is therefore given until the presence of malignant disease is definitely proved. Where disease is present, a trial of therapy is well worth while, because of the marked alleviation that may result when the tumor tissue is radiosensitive.

Supraclavicular Metastases. These are easily detectable, except when they are deep seated and diffuse. The latter type becomes more apparent when further enlargement produces a stony hard elevation of the supraclavicular space, especially at the inner triangle. Since slight elevation of the supraclavicular area, not due to neoplasm, may be seen postoperatively or in the presence of a cervical rib, the latter conditions should be differentiated from metastatic deposits. The association of supraclavicular disease with intrathoracic spread has been frequently noted and careful chest studies are therefore advised. Supraclavicular invasion may result in a severe brachial plexus neuritis or give rise to Horner's syndrome. It may also be a factor in lymphedema of the arm. Eradication of disease in this region is difficult, but should be attempted when it represents an isolated spread or when it gives rise to marked symptoms.

Skeletal Metastases. Of 159 patients hospitalized for advanced metastatic breast carcinoma, and who were followed to time of death, 124, or 78 per cent, had evidence of bone invasion shown on the roentgenogram or at postmortem examination. In 16 per cent, skeletal spread was the only manifestation of disease. Patients showing bone invasion had intrathoracic disease in 56 per cent, intra-abdominal disease in 28 per

cent. The high incidence of skeletal metastases in this series reflects the late phase of the disease. Roentgen studies offer an unusually reliable index of the presence of bone metastases, compared to the difficulty of demonstrating intra-abdominal spread or, at times, intrathoracic disease. Bone lesions are only infrequently single, although this may occur. When isolated foci are seen in the patient's earlier course, with progress of the disease new lesions will be demonstrable.

The sites of the most frequent localization have been listed before.[3,5] In the order of frequency, they are the pelvis; spine, especially the lumbar portion; femurs; ribs; skull, and shoulder girdles. Routine clinical examination, therefore, of the pelvis, chest and skull, will reveal the presence of most lesions, with more detailed roentgenographic study done where the clinical features are suggestive. The anatomic choice of localization has been explained by the occurrence of red bone marrow at the more common sites. This explanation is not entirely satisfactory. Perhaps the frequent involvement of deep-seated lymph nodes, as revealed on postmortem study, may be related to the pattern of spread.

Pain and local tenderness are the outstanding symptoms of bone invasion. When persistent, they call for careful study, including roentgen examination. Other symptoms that occur commonly are as follows: disability resulting from the severe pain or from involvement about a joint; muscle weakness and paresis due to compression of nerve roots or to spinal cord irritation by vertebral involvement; attacks of herpes zoster from the same cause. Systemically, one notes variable degrees of anemia, dependent on the extent of the disease.

Roentgenographically, the ordinary finding is a mixed picture of osteolytic and osteoblastic foci, with destructive changes most prominent. If the symptoms are constant and localized, the absence of roentgenographic confirmation should not be interpreted as ruling out metastases. The roentgenographic confirmation may not appear until a later date, and, in an occasional instance, may remain equivocal for a long time. One notes this where the bone spread is of a fine, diffuse type or spreads along the cortex, rather than the larger medullary lesions, more usually seen on the roentgenograms. Of course, if the patient shows lesions in other systems, as in the chest or skin, the diagnostic problem is simplified. A trial of therapy is justified in these instances, rather than waiting for roentgenologic proof, which may be delayed for a long time.

Early diagnosis and prompt intensive irradiation are important in cases where invasive features are present at a few sites or in one area, because these cases may receive marked palliation and be restored to a life of normal activity. The patient with bone metastases may survive not only for months, but years, and proper therapy may mean the difference between invalidism and a comfortable life for part of the time. Moreover, even a case with wide involvement may respond brilliantly, and a trial of radiation therapy should be made whenever it can be given.

The dose and manner of application of radiotherapy are determined by the therapeutic aim. If the lesions are few in number, or important because of weight bearing or the possibility of fracture or vertebral collapse, treatment is intensive. Using deep roentgen therapy by the fractionated method, a dose up to 3,000 r per field over several fields, is administered. Fractures can be irradiated through windows cut in the applied cast. If the therapy has been successful, bone healing will be seen on interval films, usually not until some time after clinical improvement has been established. The findings noted on progress films are cessation of growth of the lesion; sharpened definition of areas of destruction with sclerosis of borders; followed by recalcification, and finally, in some cases, even restoration of normal bone pattern. The healing of pathological fractures has been observed repeatedly.

Case III. A. R., aged forty-six (Montefiore

Hospital No. 38915). This woman developed intolerable pain in the cervical spine, as well as disability one year after a radical mastectomy. The film of this region taken in April, 1942, shows the destruction of the fourth cervical vertebra (Fig. 2*A*). A plaster collar and traction gave only slight relief. Radiotherapy was given with complete control of symptoms and she returned to work. Figure 2*B* shows the appearance roentgenographically in March, 1943, with complete reconstruction of the invaded bone. When reactivation appeared, fifteen months later, she again had relief and bone healing following additional radiotherapy. Other lesions throughout the body were treated and for several years she led an active existence and remained at her work until the last few months of her life. She died in January, 1946.

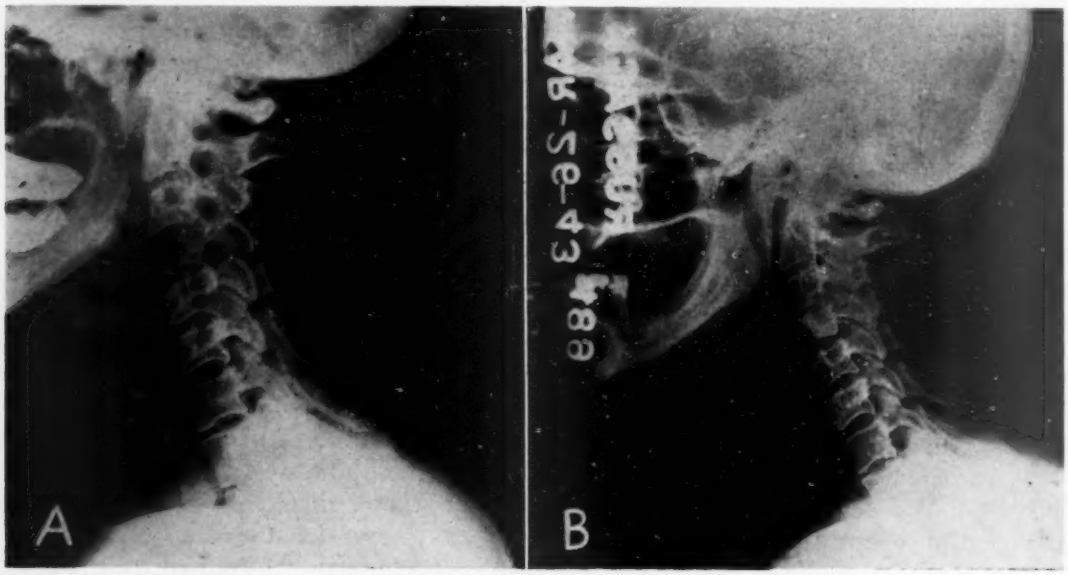

FIG. 2. Case III. (*A*) Metastasis with destruction of the fourth cervical vertebra one year following radical mastectomy for carcinoma of the left breast. (*B*) Complete reconstruction of the destroyed vertebra eleven months following roentgen therapy.

If roentgen therapy is being given for control of pain due to invasion at numerous sites, marked alleviation can often be achieved with total dosages of 1,000 to 1,500 r to a field, given in divided doses. The frequency of treatment and the number of fields depend partly on the patient's tolerance to therapy, the white blood cell count and on the relief obtained. There is often hesitation by attending physicians about permitting activity by these patients. If there are no fractures of weight bearing structures, or if vertebral collapse is responding to treatment and not causing cord irritation, it has been our custom to encourage some activity with the patient aided by suitable supporting devices. Increasing evidence is available to prove that bed rest induces and increases demineralization of bones, and that activity is of help in causing bone healing and calcium deposition.[1] Patients who are in the premenopausal or menopausal phase, and have skeletal involvement, should be routinely sterilized. The effect, at times, of this procedure in inducing a striking remission with healing of the bone lesions, and even regression of soft tissue and visceral involvement, has been noted by all workers in this field. Such effect cannot be predicted in advance, since it occurs in only 20 to 30 per cent of cases. Every case where its possibility exists should receive the benefit of a trial, because sterilization by irradiation is a simple procedure. In fact, it is incidental to the treatment of bone lesions in many of the patients, since the lesions are often located in the pelvis; 1,000 r or more at the ovary is the usual dose given to stop

ovarian function. Our postmortem examination of ovaries so irradiated has revealed complete involution, and fibrosis in all cases. Where radiotherapy is not available, surgical sterilization should be offered. Following these procedures, a positive effect regression. Several months later she noted pain in the back but roentgen studies were reported negative. She was admitted to this hospital completely bedridden, emaciated and anemic. Her entire spine, thoracic cage, pelvis and femurs were widely involved by osteolytic le-

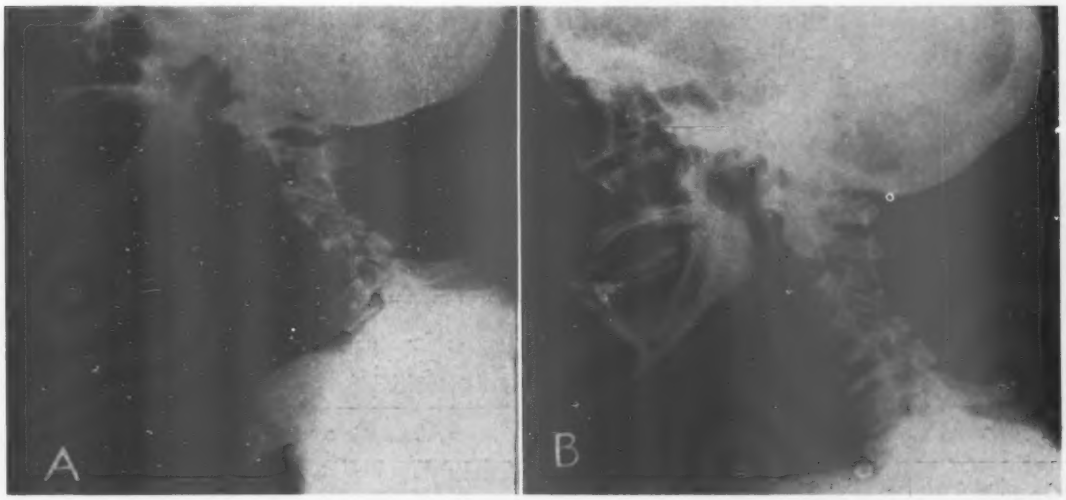

Fig. 3. Case iv. (*A*) Extensive metastases to the cervical spine with compression of the fifth and sixth bodies and fracture through the sixth spinous process. (*B*) Re-sclerosis of the vertebrae with healing of the pathological fracture following roentgen sterilization plus a few small roentgen treatments to the cervical region.

can be noted long before roentgen evidence of bone healing by the following results:

1. The improved well being of the patient.
2. The prompt alleviation of pain, not only referable to the pelvis but at more distant sites.
3. Improvement in the blood picture.
4. Only later, after clinical control is evident, signs of bone healing.

Even in favorable instances, dependence should not be placed on this procedure alone, and additional radiation therapy should be given to foci which still cause symptoms. Aided in this way, a castration effect may continue for years.

Case iv. B. J., aged forty-eight (Montefiore Hospital No. 38750). This patient was admitted in April, 1945. She had had the right breast removed for carcinoma in July, 1941. Early in 1944 a local recurrence in the operative scar was treated by radiotherapy, followed by sions. There was compression of the lower dorsal vertebrae as well as numerous fractured ribs. Figure 3*A* shows the appearance of the cervical spine with invasion of all the vertebrae, compression of the fifth and sixth bodies, and the fracture through the sixth spinous process. She had been amenorrheic for two months. Radiation therapy to the pelvis resulted in an immediate control of pain, and improved well being. Most of the symptoms referable to the cervical spine receded. A small amount of deep roentgen therapy, 1,350 r at the skin, over a period of five weeks, was given to relieve residual tenderness at this site. Figure 3*B* shows the appearance of this region five months later. In addition to the re-sclerosis of the bones, there is noted healing of the pathological fracture.

Attention should be drawn to the group of patients presenting the features of widespread osteolytic lesions and marked anemia, associated with an elevated serum calcium. This subject will be discussed in the section on hormone therapy.

INTRATHORACIC METASTASES

Table 1 gives the frequency of intrathoracic metastases in 131 postmortem examinations previously reported by us,[3] as well as the findings in an additional 75 postmortems now investigated. Intrathoracic metastases were observed in 89 per cent of the patients, which is exactly what was found previously. In only a small group were the lungs, pleura or mediastinal lymph nodes involved independently. Generally, the metastases were in all these in the pleural fluid. Forty-nine patients, or 55 per cent, were found to be involved. It is obvious from these figures that, for a large group, demonstration of intrathoracic metastases by roentgen studies alone is difficult. It is probable that in the group where roentgen demonstration is difficult, clinical symptoms are either lacking or minimal. Metastases, extensive enough to give symptoms, can usually be demonstrated by roentgen studies, especially if studies are repeated.

TABLE I

INTRATHORACIC METASTASES

Anatomical Distribution

Organs	Previous Findings		Present Findings		Combined Previous and Present Findings	
	Number	Per cent	Number	Per cent	Number	Per cent
Lungs, pleura and mediastinal lymph nodes	42	36	36	54	78	43
Lungs and pleura	40	34	12	18	52	28
Lungs alone	14	12	2	3	16	9
Lungs and mediastinal lymph nodes	12	10	8	12	20	11
Pleura and mediastinal lymph nodes	4	3	2	3	6	3
Pleura alone	2	2	4	6	6	3
Mediastinal lymph nodes alone	2	2	2	3	4	2
Pericardium alone	1	1	1	1	2	1
Heart (pericardium, epicardium, or myocardium) plus lungs and pleura	18	15	30	45	48	26

structures. The large number of patients, 45 per cent, with involvement of the pericardium, epicardium or myocardium, in addition to the lungs and pleura, is striking. In one instance, the intrathoracic metastasis was limited to the pericardium. As a rule, the heart is involved by extension of the disease from the mediastinum. The frequency of intrathoracic involvement was also estimated for 88 patients with acceptable clinical data on whom autopsies were not obtained. The diagnosis was based principally on roentgen studies but in some instances on effusions (mostly hemorrhagic), and on the finding of tumor cells

Symptoms. Cough, dyspnea and pain are the three most common symptoms of intrathoracic metastases. Occasionally, physical signs indicative of a pleural effusion may call attention to metastases before other symptoms appear. Chest pain, which is associated with localized tenderness, usually means an adhesive pleurisy, which may later change to an effusion. Sometimes, an elevated temperature will accompany pleuritic involvement.

With mediastinal spread, it is not uncommon to observe obstruction of the superior vena cava. The important symptoms indicative of this syndrome are dilated

veins of either the cervical region, neck, chest, arms or abdomen, and edema in the distribution of the superior vena cava. Other findings, which may be present, are those due to mediastinal compression, such as dyspnea, cough, pleural effusion, cyanosis, hoarseness and dysphagia. The following case is an example:

Case v. D. S., aged thirty-five (Montefiore Hospital No. 43891). This patient was admitted to Montefiore Hospital eighteen months following a radical mastectomy for infiltrating duct cell carcinoma with positive axillary glands. Her principal complaints were dyspnea, orthopnea, swelling of the face, neck, arms and legs. On examination, she showed the classical picture of superior vena cava pressure, including dilatation of the veins of the neck and chest wall. Roentgenograms revealed bilateral hydropneumothorax with tremendous enlargement of the superior mediastinum. Venous pressure studies of the upper and lower extremities confirmed the diagnosis. The postmortem study showed obstruction of the superior vena cava, edema of the upper extremities, left breast, neck and face; also metastases to the lungs, pleura, pericardium, anterior and posterior mediastinum, peri-aortic and peri-esophageal lymph nodes and liver.

Therapy. Radiotherapy has a definite place in the treatment of intrathoracic metastases. The purely parenchymal spread, which causes no symptoms, does not require treatment. Cough will be controlled by codeine in adequate dosage, but where there is pressure on the trachea and bronchi, it is ineffective, and morphine becomes necessary. Radiotherapy has its principal value in the treatment of pleural and mediastinal metastases, which are giving rise to symptoms. Mediastinal masses can be reduced with corresponding relief of pressure symptoms. When pleural involvement predominates, radiotherapy may give surprising relief. Cough, dyspnea, orthopnea and pain are greatly improved and sometimes disappear. Pleural effusions have vanished or else refilling is very slow. Dosage must be adequate, at least 2,000 to 3,000 r over two or three fields. The following case is illustrative:

Case vi. K. F., aged thirty-six (Montefiore Hospital No. 17716). This patient had a history of a small lump in the lower right breast of one month duration, which was excised by the local doctor in his office. The histopathological report was adenocarcinoma. Nothing further was done for three months. She was then referred to the Montefiore Hospital where a radical mastectomy was performed. Careful search of the resected breast and axillary tissues revealed no carcinoma. Four and one-half years later, a recurrence appeared in the scar and was resected. Six years following the mastectomy, she developed a right pleural effusion and metastases in the lumbar spine. The effusion was aspirated and tissue in the fluid revealed adenocarcinoma. She was given high voltage roentgen therapy over the lumbar spine, pelvis and chest with the following factors: 200 kv., filter 0.5 mm. Cu plus 1.0 mm. Al, at 50 cm. focus skin distance.

12/16/35–1/4/36
1,275 r over the lumbar spine
1/6/36–1/27/36
900 r to each of two anterior, and two posterior pelvic portals
12/26/35–3/10/36

Posterior right upper chest	2,400 r
Anterior right upper chest	2,100 r
Anterior right lower chest	2,100 r
Posterior right lower chest	2,150 r
Lateral right chest	1,650 r

The irradiation was followed by marked improvement in the skeletal pain, also in the dyspnea, palpitation and cough. Over a period of years, the right chest wall gradually contracted and the irradiated area showed severe radiation damage. For ten years, the patient was well and working, with no complaints requiring further treatment. She then developed infiltration in the right supraclavicular region and paralysis of the right upper extremity. Later, she also developed cerebral metastasis. She died suddenly on June 11, 1946, sixteen years and nine months following the radical mastectomy. This is an example of an excellent response to irradiation of intrathoracic and skeletal metastases.

Oxygen, codeine, and if needed, morphine, may help to tide over a severely orthopneic patient until irradiation becomes effective.

Castration in isolated instances may be responsible for remarkable recessions in

pulmonary or pleural involvement. For example:

CASE VII. E. W., aged thirty-nine (Montefiore Hospital No. 38687). This patient had a right radical mastectomy for carcinoma with positive axillary nodes. Three years later she developed nodular infiltrations in the right lung and a right pleural effusion (Fig. 4*A*). Osteoplastic metastases had previously been found in the right pelvis and femur. Aspiration of the right chest was done and the pleural fluid showed tumor cells. A bilateral salpingo-oophorectomy was performed, and the operation disclosed metastases to both ovaries and the left fallopian tube. About two months following castration, the patient's general condition improved suddenly, her chest symptoms began to lessen and a roentgenogram of the chest showed partial absorption of the pleural effusion and regression of the pulmonary infiltrations. Roentgenograms, sixteen months after operation, showed regression of all pulmonary lesions except for a small effusion at the right base (Fig. 4*B*). The patient continued fully active without symptoms or any need for treatment referable to the chest lesions for a period of two years. Skeletal pain then recurred and the patient was readmitted to the hospital. She was started on testosterone propionate intramuscularly, and received a total of 700 mg. over a period of two weeks. This induced a hypercalcemia with resultant lethargy and persistent vomiting. Corrective therapy was immediately instituted (parenteral fluids and sodium citrate intravenously). In a few weeks she was completely recovered. Soon thereafter she was again started on testosterone to observe its effect on the blood calcium. When she had received 200 mg., lethargy and pernicious vomiting recurred, although the blood calcium remained unchanged. She died a few days later in spite of supportive therapy. The postmortem revealed metastases to the left breast, lungs, thyroid, adrenals, left ureter, intestines, skeletal system and to the cervical, tracheobronchial, perigastric, periportal and retroperitoneal lymph nodes.

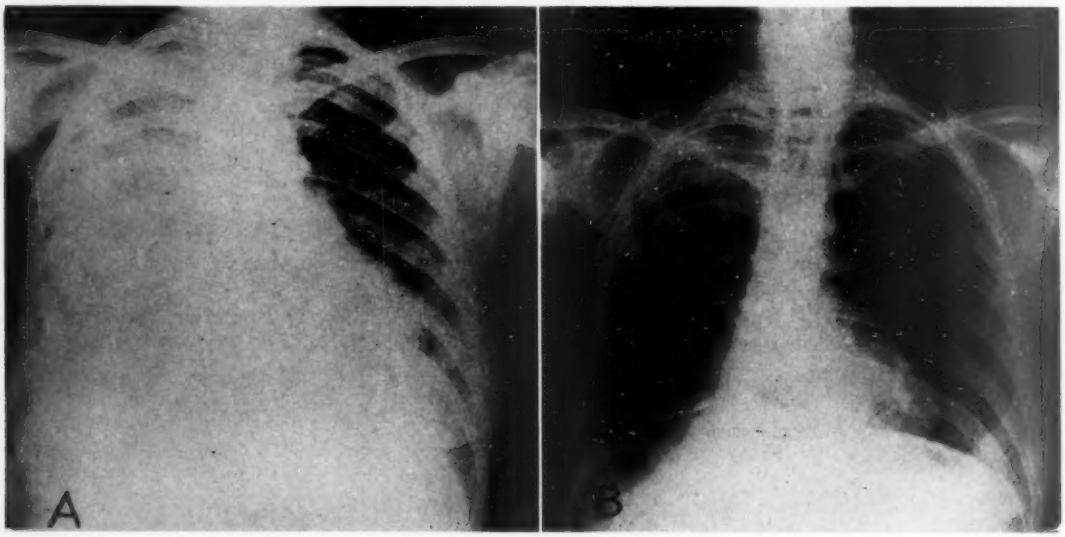

FIG. 4. Case VII. (*A*) Nodular metastases to the right lung plus a right pleural effusion three years following radical mastectomy for carcinoma of the right breast. (*B*) Film sixteen months following surgical castration shows regression of all pulmonary lesions except for a small effusion at the right base.

We have also observed the same striking regression of pulmonary and pleural lesions following roentgen castration. The resolution of these lesions is a castration effect and we believe the results are similar whether the castration is done surgically or is achieved by roentgen therapy.

INTRA-ABDOMINAL METASTASES

Table II shows the incidence of intra-abdominal metastases previously reported,[3] and the present findings from an additional 75 postmortem examinations. It is striking

that the liver, adrenals and abdominal lymph nodes are positive in more than 50 per cent of the patients. The spleen, ovary and kidneys are also involved with great frequency.

Symptomatology. Clinical symptomatology and laboratory findings may be aids in the management of intra-abdominal metastases. Since multiple organs are usually involved, the complaints are many and often confusing. Abdominal pain may result from metastases to the skeleton, the abdominal glands, the liver and rarely other viscera. Bone metastases have already been discussed. When the abdominal glands are involved, usually more than one group are positive (para-aortic, periportal, retroperitoneal, mesenteric, etc.). Pain results from pressure on adjacent nerves. It may be localized to a particular region or it may be shifting. It may even be radicular in character if the retroperitoneal nodes are enlarged and produce nerve pressure. At times, pain may be related to meals and be suggestive of a gastric ulcer or a primary gastrointestinal malignancy. Nausea, vomiting, gaseous or acid eructations and a sense of fullness after eating may be indicative of liver metastases or masses in the upper abdomen. Jaundice and elevated temperature may accompany intra- or extrahepatic lesions. Not uncommonly, as shown at postmortem examination, the common duct is obstructed by a glandular mass with resulting jaundice. A careful history should be elicited even from patients suffering with metastases because often diseases not related to the malignancy may be discovered. On occasion, jaundice may result from obstruction of the common duct by a gallstone. Such patients can be relieved by operation. Liver function tests may be an aid in differentiating obstructive jaundice from hepatitis. Diarrhea, constipation or intestinal obstruction may result from direct involvement of the intestine or

TABLE II

INTRA-ABDOMINAL METASTASES

Anatomical Distribution

Organs	Previous Findings		Present Findings		Total of Previous and Present Findings	
	Number	Per cent	Number	Per cent	Number	Per cent
Liver	85	65	45	60	130	63
Adrenals	51	39	39	52	90	43
Ovary	28	21	19	25	47	23
Spleen	24	18	19	25	43	21
Kidney	20	15	16	21	36	17
Pancreas	16	12	5	7	21	10
Peritoneum	14	10	5	6	19	9
Uterus	10	7	3	4	13	6
Stomach	7	5	5	7	12	6
Mesentery	5	3	4	5	9	4
Intestines	4	3	7	9	11	5
Omentum	4	3	3	4	7	3
Gallbladder	3	2	4	5	7	3
Vagina	2	1	1	1	3	1
Urinary bladder	2	1	1	1	3	1
Esophagus	1	0.7	1	1	2	1
Ureters	1	0.7	6	8	7	3
Intra-abdominal lymph nodes			40	54		

from irritation or pressure from adjacent glandular masses.

Ascites due to portal obstruction or to generalized peritoneal metastases requires paracentesis to relieve abdominal discomfort.

We have observed urinary disturbances due to ureteral obstruction, either by metastases in the wall of the ureter or by pressure from external masses. If this continues unrelieved, it produces hydronephrosis, and, later, pyelonephritis due to ascending infection. The resulting uremia and sepsis may cause death. Intravenous urography and blood chemistry determinations are an aid in diagnosis.

Weakness, cachexia and loss of weight are common accompaniments of intra-abdominal metastases and are due to anemia, inability to retain food, toxic absorption from broken down tumor, infection and adrenal metastases.

Therapy. Before therapy can be instituted, the extent of the intra-abdominal involvement must be known. Pain due to enlarged retroperitoneal or mesenteric glands can be relieved by irradiation. When it is due to an enlarged metastatic liver, it can, on rare occasions, be improved by small doses of irradiation, providing radiation sickness is not severe. Jaundice caused by pressure of enlarged glands on the common duct may be relieved by radiotherapy or surgery, providing a correct diagnosis can be made. If the jaundice is secondary to diffuse intrahepatic metastases, little can be accomplished.

Ascites is sometimes decreased by irradiation applied principally over the lower pelvic and portal regions. Genitourinary complaints, due to ureteral obstruction, can be helped by roentgen therapy if the obstruction is demonstrable. Medical treatment of the complicating uremia, with careful control of the nitrogenous waste products and the electrolytes of the blood is important. Weakness and cachexia are materially improved by intravenous feedings and blood transfusions, repeated as often as necessary.

CENTRAL NERVOUS SYSTEM

Metastases to the central nervous system from carcinoma of the breast is a more common occurrence than is generally believed. In a previous communication,[3] the authors reported involvement of the brain in 20 per cent and the cord in 7.5 per cent of patients under observation until death. To bring these figures to date, 175 additional protocols of patients who died have been investigated. Although many of the cases studied had postmortem examinations, permission for the removal of brain and cord were relatively few. Postmortem studies corroborated clinical findings of the intracranial involvement in 16 cases.

Intracranial Involvement. Forty-seven cases, or 27 per cent, showed symptoms or signs indicative of intracranial metastases. The skull was involved in 66 per cent of these cases. Postmortem studies disclosed the metastases to be more often multiple than single. Localizations of the autopsied material are noted in Table III. The most

Table III

INTRACRANIAL METASTASES

Anatomical Distribution

Localization or Site	Previous Findings in 39 Cases	Present Findings in 16 Cases	Combined Previous and Present Findings in 55 Cases
Cerebrum	23	7	30
Meninges	22	9	31
Cerebellum	6	0	6
Pituitary gland	4	5	9
Brain stem	2		2
Pineal gland	2	1	3

frequent sites were the cerebrum and meninges. Symptoms are those usually associated with brain lesions such as increased intracranial pressure, localizing signs alone, or both. Cranial nerve signs due to metastases along the base of the brain or to irritation from metastases in the skull

are a very common finding. Involvement of the pituitary gland was sometimes suggested by symptoms of diabetes insipidus. In a few instances, the brain involvement was discovered at the postmortem examination, the clinical examination having been negative.

Spinal Cord Involvement. Eleven cases, or 6 per cent, showed symptoms referable to the spinal cord. The findings are almost always due to compression of the spinal cord by a metastatic focus in the corresponding vertebra. In some instances, extension takes place from the involved spine to the meninges. In previous reports,[3,5] we have believed true metastases to the cord to be almost non-existent, since, with one exception, postmortem examinations had shown cord symptoms to be due to pressure or extension. In the past year, we have observed at the Montefiore Hospital, 2 cases of metastases to the cord without involvement of the adjacent spine and one of the authors (J.R.F.) has seen an additional case in his private practice.

Therapy. Intracranial and cord involvement usually takes place in the terminal stages of the disease. Treatment of the central nervous system lesions in these patients is only undertaken to relieve particularly distressing symptoms due to pressure. For the treatment of patients in good general condition and not in the terminal phases of their ailment, the general rules for the management of neoplasms of the central nervous system apply. If intracranial pressure is increased, the earliest treatment is its relief by general measures, such as spinal tap, intravenous hypertonic solutions, etc. If unsuccessful, decompression is advisable, to be followed later by intensive high voltage roentgen therapy given carefully, guarding against increased pressure due to edema. When the lesion apparently is single and pressure is not increased, and if metastases are not demonstrated elsewhere, guarded roentgen therapy is advisable. However, surgical intervention may be indicated if the neurosurgeon believes he can remove the lesion in its entirety. The following case is illustrative:

Case viii. E. S., aged fifty-two (Montefiore Hospital No. 36848). This woman had a left radical mastectomy for carcinoma. Four years later, a local recurrence appeared which was treated by excision and irradiation. At this time, she complained of spots before her eyes and dizziness. Ten months later, there was onset of severe headaches, vomiting, dimming of vision, occasional lapses of memory and inability to concentrate. On examination, the important findings were contraction of the visual fields, bilateral papilledema, weakness of the right sixth cranial nerve, as well as left lower facial weakness. Metastasis to the right temporal lobe was diagnosed. A craniotomy was done and considerable carcinomatous tissue was found. As much of the tumor tissue as possible was removed. The microscopic diagnosis was metastatic carcinoma. The patient was well for seven years without further treatment. She then developed cerebral features of vomiting, epileptiform convulsions and stupor, which led to death. The postmortem examination showed recurrent adenocarcinoma of the left breast with metastases to the skin, skeleton, thyroid, liver, adrenals and abdominal lymph nodes. The brain showed metastases to the dura and a massive area of invasion in the temporoparietal and occipital convolutions. The relief of cerebral symptoms for seven years is a striking example of what can be done by surgery if the metastasis is single and amenable to surgery.

If roentgen therapy is given, the tumor dose should be adequate, at least 3,000 r to the areas treated. Cranial nerve symptoms, due to lesions along the base of the brain, are the most easily relieved. Symptoms of increased intracranial pressure, headaches, dizziness, etc., have abated; in others, there has been disappearance of psychic features. Although the results are not always good, the improvement has sometimes persisted for years. The following case report is an example of what can be accomplished by irradiation.

Case ix. D. S., aged forty-one (Montefiore Hospital No. 29564). This patient had a radical mastectomy for carcinoma of the left breast with axillary metastases. A year later, she noted frontoparietal headaches, loss of vision in the

right eye and loss of strength and control of both upper extremities. Prior to her admission, she also developed loss of vision in the left eye, difficulty in chewing and swallowing, tinnitus, and partial loss of hearing on the left side. A film of the skull showed complete destruction of the sella turcica and adjacent structures (Fig. 5*A*). There was no involvement elsewhere. She was given intensive high voltage roentgen therapy over the skull. Though her blindness was permanent, other features improved remarkably. There was regression of psychotic manifestations, improvement in the neurological status, and reconstitution of the sella (Fig. 5*B*). She later developed metastases to the pelvis and spread to the skin and viscera. She lived twenty months following radiotherapy to the brain, with no recurrence of her neurological symptoms.

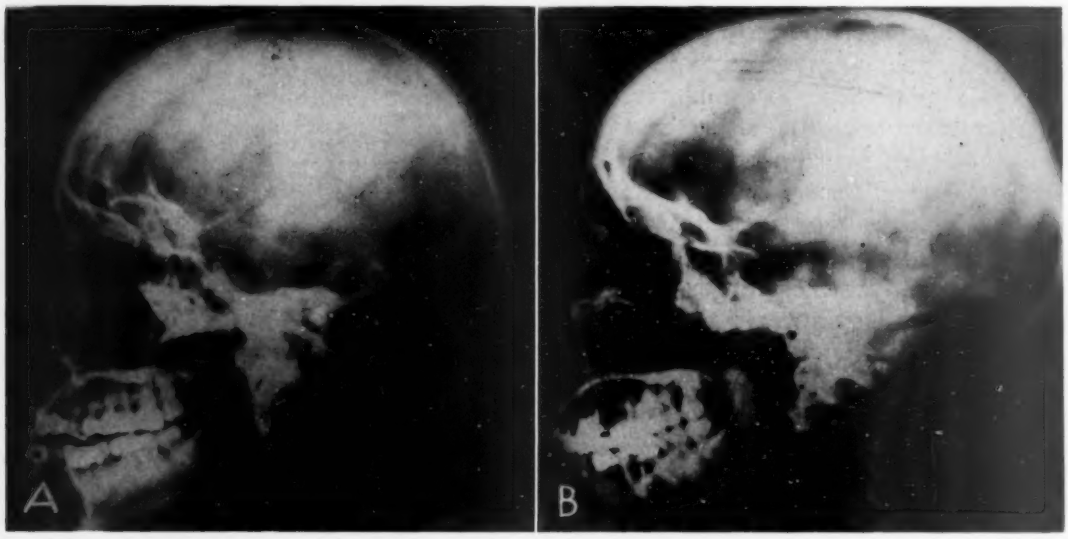

FIG. 5. Case IX. (*A*) Destruction of the sella turcica in a patient with intracranial metastases one year following a left radical mastectomy. (*B*) Reconstitution of the sella turcica twelve months following intensive roentgen therapy over the skull.

The rules laid down for treating intracranial lesions apply in great measure to the spinal cord. If cord pressure is slight or moderate, we give roentgen therapy with careful supervision, guarding against increased pressure due to edema. For transverse myelitis of relatively short duration, or for moderate to severe cord pressure, an immediate laminectomy is advisable to avoid permanent cord injury; this is followed by intensive roentgen therapy. Patients with a true metastasis to the cord probably do best with irradiation since these lesions cannot be resected without permanent damage to the cord. However, our experience with roentgen therapy for intramedullary involvement is limited. Symptoms due to pressure or to infiltration of the dura or cord have been relieved by irradiation to the extent that some cases with paresis of the extremities have recovered function. The following case is illustrative:

CASE X. S. G., aged forty-seven (Montefiore Hospital No. 31755). This woman had had a left radical mastectomy for carcinoma ten years previously while in Cairo, Egypt. She was symptom free for eight years and then developed pain in the body and limbs. Within four months, she was completely bedridden. While in the Aegean Islands and in Italy, she received roentgen therapy without any relief. She was admitted to Montefiore Hospital in March, 1940, bedridden and incontinent of urine. The important positive findings were left mastectomy scar, spastic paraplegia, bilateral hyperreflexia with ankle and patellar clonus, a positive Babinski sign, and a sensory level at the third and fourth dorsal vertebrae. Roentgenograms showed extensive skeletal metastases with par-

tial collapse of the second, third and fourth dorsal bodies. She was given intensive high voltage roentgen therapy over the spine, pelvis and other areas of skeletal pain. Within four months, she experienced marked relief of pain, began to move her legs, incontinence disappeared and she slowly thereafter started to walk with assistance. She did well for eighteen months and then was readmitted for further roentgen therapy to the left hip and right arm. Over the next three years, she was given several courses of irradiation for skeletal pain. Finally, four years following her first admission to this hospital, she died after spread of the cancer to the lung and skin, in addition to the skeletal system. Except for difficulty in walking, relief of extramedullary cord pressure was maintained over three years.

Usually, little is to be expected with transverse myelitis of long standing, because cord damage is probably irreparable. Tumor dosage to the cord lesions should be at least 3,000 r if good results are anticipated.

SURGICAL MEASURES FOR RELIEF OF PAIN

Pain suffered by patients with metastases from carcinoma of the breast is usually due to skeletal involvement, less frequently to visceral or glandular spread. It is generally controlled by irradiation or hormone therapy. When these fail and the patient is in the terminal phases of the disease, drugs are resorted to. However, some individuals are not influenced by irradiation or hormones even in the early stages.Narcotic drugs in large doses are depressing in these cases, with the additional possibility of addiction. They also result in the loss of appetite, and in wasting. The life span of these patients is definitely shortened by resorting to this measure. For this group, one should seriously consider surgical methods, such as alcohol injection, posterior rhizotomy, anterolateral chordotomy and prefrontal lobotomy for relief of distressing symptoms.

Alcohol Injection. The injection of nerve trunks by alcohol for relief of pain is a well known procedure. The alcohol causes degeneration of the motor and sensory fibers with resulting paralysis and anesthesia. It is useful in paralyzing the intercostal nerves when given paravertebrally. Intraspinal subarachnoid injection is also done frequently. However, damage to surrounding structures and motor paralysis may follow. On occasion, we have noted instances of cord damage with symptoms of a transverse myelitis. We rarely recommend this procedure for patients with breast cancer for the foregoing reasons, and because of the limited anesthesia achieved in those patients with widespread pain.

Anterolateral Chordotomy. Section of the anterolateral spinothalamic tracts is an effective means of relieving intractable pain below the mid-dorsal region. It is the best of the older surgical measures for controlling pain due to metastatic disease to bone, particularly the vertebrae. It should be done only on patients with a life expectancy of at least six months.

Prefrontal Lobotomy. The treatment of psychotic patients by surgical interruption of the frontal association pathways (prefrontal lobotomy) was first carried out by Egas Moniz in 1935. Freeman and Watts[4] have established the usefulness of this operation in agitated depression; in severe chronic anxiety states and particularly in severe chronic obsessive-compulsive states. Lately, prefrontal lobotomy has been performed on patients suffering from pain not relieved by other measures. The operation does not affect the underlying disease but markedly reduces the perception of pain by interrupting the association pathways in the frontal lobes along which the pain stimuli travel. The following case report is that of a patient so treated.

Case xi. M. G., aged forty-seven (Montefiore Hospital No. 43502). This patient was admitted to Montefiore Hospital with severe pain in the back and lower extremities three years following a right radical mastectomy for carcinoma. For a short time, testosterone afforded some relief. When this failed, she was given morphine every three hours to the point of addiction. The neurosurgeons advised against chordotomy be-

cause of the patient's limited life expectancy, and because it would not relieve her of the drug habit. A bilateral prefrontal lobotomy was therefore performed. She did well, and when discharged one month postoperatively, she was eating better, complained of no pain and was not taking drugs. Her personality changes were difficult to evaluate. Her attitude was marked by passivity and by disinterest in her personal problems and her environment. She did well for two months, when pain recurred in her right lower extremity. She is unable to describe this pain, and at times, contradicts herself and says there is no pain. Her present symptoms are controlled by aspirin. Other than pain in her right lower extremity, her complaints have all been relieved by the lobotomy.

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HORMONAL THERAPY OF BREAST CANCER

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THE production of hormonal imbalance by the withdrawal of hormones (castration) in order to cause regression of mammary carcinoma and an amelioration of symptoms is a relatively old therapeutic measure.[1,2] More recently the converse procedure, the creation of an imbalance by the addition of androgenic and estrogenic hormones has been tried and found to be of therapeutic value in a number of patients with advanced mammary cancer.[3–17]

Use of Androgenic Hormone in Advanced Cancer of the Breast. The results obtained from the use of testosterone propionate in the treatment of osseous metastases are striking in a number of cases. There is amelioration of pain within a week or ten days after therapy is initiated followed by a feeling of well being and an improvement in the patient's general physical condition. The symptomatic improvement is often associated with roentgenographic evidence of a deposition of calcium in the osteolytic metastatic areas. Occasionally normal appearing trabeculation fills in the areas of osteolysis. The roentgenographic changes usually become evident two or three months after treatment is started.

An increase in the serum alkaline phosphatase is often found concomitant with the osteoblastic changes, and as this enzyme is essential for bone formation, its level in the blood may be used as an index of bone regeneration or of osteoblastic activity. Whether the recalcification indicates new bone formation or a change from an osteolytic to an osteoblastic type of metastasis is not known. However, the facts remain that change from an osteolytic to an osteoblastic state is associated with a

diminution of pain in the involved areas and a decreased liability to pathological fracture.

Favorable results following the prophylactic administration of testosterone propionate have been reported.[18] It is the writer's opinion that this agent should be reserved for treatment.

The treatment can be effective at any age, and in menstruating, castrated or postmenopausal women. A temporary amenorrhea can be induced in regularly menstruating patients but the menses return when the hormone is withdrawn. The optimum dose established in the original investigations was 100 mg. three times a week for six weeks.[11] The writer has subsequently used 50 mg. three times a week for six weeks with good results in a number of patients. The androgen may be withdrawn after six weeks and the patient in most instances will continue to improve. Protracted treatment is usually unnecessary. If there has been no significant diminution of pain after eight weeks of therapy further hormone administration usually continues to be ineffective.

The duration of the beneficial effects of androgen therapy is at present variable. Some patients have been kept asymptomatic for several years by the exclusive use of the androgen. Symptomatic improvement may occur in some patients despite the absence of demonstrable changes in the lesions. New areas of osteolytic involvement may appear while pre-existent osteolytic areas are becoming calcified.

Many patients from whom testosterone propionate is withdrawn after an initial regression of the osseous and soft tissue lesions fail to respond to additional androgen treatment if the metastases become reactivated or if new ones appear. It may be that the initial favorable response of the lesions to the hormone is due to depression by the androgen of the gonadotropic function of the pituitary gland which results in a suppression of ovarian estrogen production; and that subsequently the function of elaborating estrogenic hormones is taken over by the adrenals which are not influenced by the administration of androgens.

It is my opinion that the following are some of the advantages of sex hormone therapy of advanced mammary cancer. Multiple and widely dispersed areas of bone destruction require no more therapy than a single lesion. The treatment does not injure the skin, which is an important factor in bedridden patients, and the hormone can be administered to these patients at home thus eliminating costly hospitalization. The production of unsightly pigmentation of exposed areas can be avoided and head lesions can usually be treated without producing a depilatory effect. These factors are of considerable importance for the patient's psychological as well as physical well being.

The following case illustrates the effectiveness of hormonal therapy in a patient with osteolytic metastases.

Case 1. I. E., a female, aged fifty-one, underwent a left radical mastectomy followed by roentgen therapy for mammary carcinoma in 1938. She remained asymptomatic and apparently free of disease for eight years (1946) and then pain developed in the right shoulder. The pain became so intense that active motion was precluded. Physical examination disclosed no evidence of local recurrence of the disease. Roentgenologic studies showed metastatic involvement of the neck and glenoid fossa of the right scapula (Fig. 1). Roentgenograms of the chest, lumbar spine and pelvis were negative for evidence of metastasis. The patient's menses were regular.

Testosterone propionate 100 mg. three times a week was administered intramuscularly for a six weeks' period beginning October 12, 1946. No other therapy was employed. Within one week the intensity of the pain decreased. At the end of six weeks there was a fair range of active motion in the joint, and at the end of ten weeks the pain was gone and the function of the right shoulder was almost completely restored. Roentgenologic studies at this time showed a deposition of calcium in the metastatic areas (Fig. 2). Roentgenograms of the chest, lumbar spine and pelvis failed to show evidence of metastasis. The therapy caused amenorrhea, slight facial hirsutism, a gain in body weight

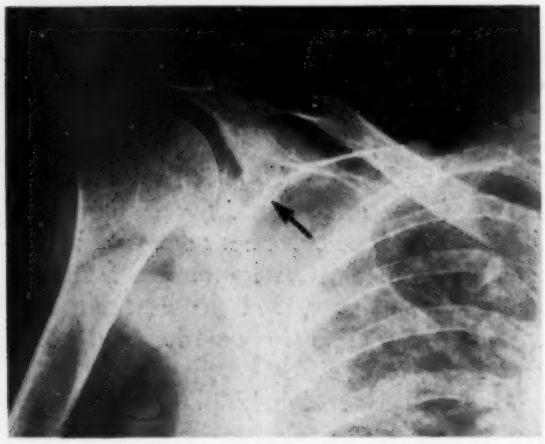

Fig. 1. Case 1. Arrow points to osteolytic metastasis in the neck and glenoid fossa of the scapula.

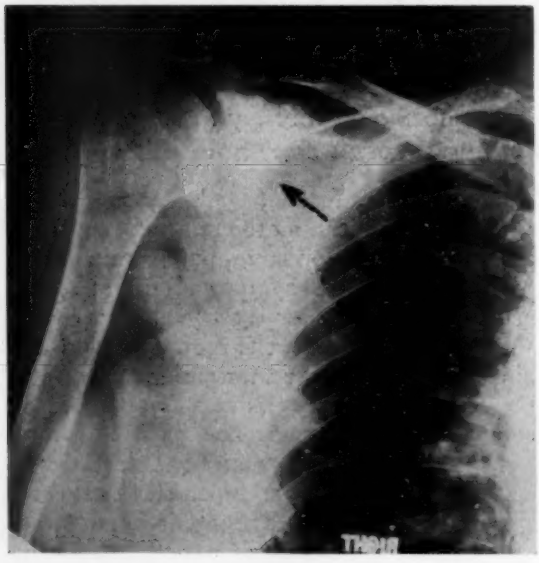

Fig. 2. Case 1. This roentgenogram was taken two and one-half months after that shown in the previous figure. In that interval the patient had received 1,800 mg. of testosterone propionate. There is calcification in the areas of osteolysis.

and an increase in libido associated with a mucoid vaginal discharge. The menses returned and the other phenomena regressed after the androgen was withdrawn.

The patient was asymptomatic for nine months and then pain developed in the right chest and cough. There was roentgenological evidence of fluid at the base of the right lung. Roentgen therapy was administered to this region with prompt subsidence of the pain and cough. There has been no return, at any time, of the pain and disability in the right shoulder. The patient is asymptomatic at present over two years since testosterone therapy was initiated. The patient's menses are regular.

Osseous and soft tissue lesions which have recurred or have become reactivated after an initial favorable response to testosterone propionate may be effectively treated by roentgen therapy and conversely bone lesions may be successfully treated with the androgen if roentgen therapy is ineffective, or if a relapse occurs after initial improvement from the roentgen treatment. The cause of this dual response may be that the roentgen rays exert their effect by direct action on the lesions whereas the hormone influences the lesions indirectly by acting on the pituitary.

The following case illustrates the favorable response of osteolytic metastases to androgen therapy when roentgen therapy and roentgen castration were ineffectual.

Case II. R. K., a female, aged fifty, underwent a right radical mastectomy in 1943 for carcinoma and a left radical mastectomy three years later for scirrhous carcinoma with axillary node metastasis. She developed back pain shortly after the second operation. Roentgenograms taken in April, 1946, showed osteolytic changes in the third lumbar vertebra and in the left sacroiliac region. The patient was then given 1,200 r high voltage roentgen therapy to each of the involved areas. Her menses ceased in June, 1946.

The pain in the back became increasingly severe and she walked with great difficulty. In August, 1946, roentgenograms showed the third lumbar vertebra, the pelvis and upper thirds of the femora and the second rib to be riddled with osteolytic metastases (Fig. 3). There was no roentgenographic evidence of pulmonary metastasis and no external evidence of recurrent or metastatic disease. Roentgen therapy was again given from August 20, 1946 to September 8, 1946, the patient receiving 1,220 r to each of four pelvic portals, 2 anterior and 2 posterior. Despite roentgen therapy the pain in the back and hips persisted, incapacitating the patient.

Two months later (November 2, 1946) testosterone therapy was initiated, 50 mg. triweekly intramuscularly, over a six weeks' period for a total of 900 mg. After three weeks of

hormonal therapy there was considerable diminution of the pain, and one month after testosterone therapy was terminated the patient was asymptomatic. Roentgen studies of the lumbar spine, pelvis and upper femora made December 30, 1946, showed widespread recalcification in the areas of osteolysis (Fig. 4). The patient returned to work and was asymptomatic for one and one-half years. Subsequently the lesions became decalcified and she sustained a pathological fracture of the right femur. Resumption of androgen therapy failed to influence the lesions.

The evidence at present seems to indicate that roentgen therapy or castration employed concurrently with androgen therapy does not produce more satisfactory results than could be expected from each agent employed individually.[19,20] It would appear more advantageous to employ these agents separately rather than concurrently. By using each procedure for its full effectiveness it may be possible to obtain the maximum therapeutic effect over an extended period of time.

Regressive changes in soft tissue lesions as a result of testosterone therapy are produced in some women, and in some cases histopathologic studies reveal pyknotic, deeply staining, irregular nuclei and vacuolated cytoplasm.[9,10] The vaginal smears may show the atrophic picture characteristic of a full androgenic effect despite the fact that there is no evidence of regression of the lesions.[10] However, neither the same dose nor doses very much larger than those which produce symptomatic and structural changes in osseous metastases influence soft tissue lesions in most patients and large doses may produce tinnitus, dizziness or edema.

There are undesirable sequelae of testosterone therapy such as facial hirsutism, acneform eruption on the neck and thorax, deepening of the voice, dizziness and edema. The edema may overtax a badly damaged cardiovascular system. In one of my patients the androgen produced an extensive alopecia. An increase in the patient's libido is frequently encountered and

Fig. 3. Case II. There are numerous areas of osteolysis, some of which are indicated by arrows.

Fig. 4. Case II. This roentgenogram, taken four months after the one shown in the previous figure, reveals calcification in the osteolytic areas. In the interval between the two roentgenograms, the patient received 900 mg. of testosterone propionate.

there is usually an increase in body weight due to nitrogen and water retention.[9,10,11,21] The weight is lost after the treatment is terminated.

An infrequent but serious complication of androgenic therapy is the production of a toxic hypercalcemia.[22,23] The serum calcium usually remains unchanged despite extensive osteolysis. However, an occasional patient will develop a toxic hypercalcemia in the course of androgenic treatment despite initial normal serum calcium levels. Also an occasional patient will manifest a spontaneous hypercalcemia in consequence of widespread bone destruc-

tion.[24] The administration of androgens to these patients may further elevate the serum calcium and initiate a toxic reaction.

The utmost caution should be observed in administering androgenic hormones to patients with pretreatment hypercalcemia or with badly damaged kidneys. Frequent blood chemical and kidney function determinations are essential in these cases. Hypercalcemia should be suspected if nausea, vomiting or depression supervene during testosterone therapy. The excess calcium excreted through the kidneys can produce renal damage, frequently associated with calcinosis of the renal tubules, which results in azotemia. Hepatic or cerebral metastases may produce nausea and vomiting but localizing signs are present and hypercalcemia is absent in these cases.

Early recognition of hypercalcemia and institution of corrective therapy may prevent a fatal termination. The hormone should be withdrawn promptly and 2.5 per cent sodium citrate solution in 250 cc. quantities should be given intravenously. Fluids should be forced by mouth and parenterally.

Use of Estrogenic Hormone in Advanced Cancer of the Breast. Regression of soft tissue lesions, especially pulmonary metastases, has been obtained by the exclusive use of the synthetic as well as the naturally occurring estrogenic hormones in women above the age of sixty with advanced mammary cancer.[13–17] Improvement in many cases can be produced by the oral administration of 5 to 15 mg. of diethylstilbestrol daily for six to eight weeks. In the writer's experience if favorable results are not obtained within twelve weeks continued estrogen administration is usually ineffective. The soft tissue lesions are more responsive to the estrogenic therapy than are the osseous metastases. The treatment produces fullness of the breasts, diffuse pinkness of the overlying skin and a deep brownish black pigmentation of the areolae and nipples. Vaginal smears at the end of six to eight weeks of therapy usually show a full estrous effect.[17] Cytological changes in the neoplasm similar to those seen after androgen therapy have been reported in some instances.[13] Recurrence and extension of the soft tissue lesions take place despite continuation of the therapy. There may be danger of accelerating the growth of the lesions if estrogens are administered to women with advanced mammary cancer in the premenopausal years. In one patient, aged forty, menstruating, the growth of an advanced breast cancer appeared to be stimulated by treatment with the estrogenic hormone.[17]

The following cases illustrate regression of pulmonary lesions subsequent to estrogen therapy. In one of these patients osteolytic lesions became recalcified concomitant with regression of the pulmonary lesions.

CASE III. M. F., a female, aged sixty-eight when first seen on August 8, 1946, complained of a constant, non-productive cough and of a lump in the right breast, both conditions, according to the patient, of approximately four months' duration.

Examination revealed a firm mass about 5 cm. in diameter in the upper outer quadrant of the right breast. The overlying skin was dimpled. There was a large, bulky mass of confluent lymph nodes palpable in the right axilla. Aspiration biopsy of the breast mass was reported as carcinoma. Roentgenograms of the chest showed evidence of metastasis at the base of the left lung.

During the month of August, 1946, the patient was given high voltage roentgen therapy 1,800 r to the right axilla, 2,100 r to an anterior mediastinal field and 2,100 r to a posterior mediastinal field, all in fractionated doses. Two months after completion of the roentgen therapy the cough was worse and the mass in the right axilla unchanged. Roentgen studies of the chest at this time showed multiple metastases in both lung fields (Fig. 5).

Oral estrogen therapy, 3 mg. of diethylstilbestrol daily, was started early in November, 1946. After two months of treatment the cough diminished appreciably and the mass of nodes in the right axilla regressed completely. After five months of oral estrogen therapy, 3 mg. daily, the cough was completely gone. Roent-

genograms taken at this time (March, 1947) showed regression of the pulmonary metastases (Fig. 6). The diethylstilbestrol therapy was terminated. Irregular uterine bleeding which had appeared within three weeks after hormonal therapy was instituted persisted until the estrogen was withdrawn.

The patient remained asymptomatic for eight months and then a slight cough reappeared. Oral diethylstilbestrol treatment 3 mg. daily was again instituted. The cough continued but at no time with its original severity. Metastatic nodules have appeared recently in the skin of the right breast and right anterior axillary fold. Despite these signs of disease progression the patient is active and in good physical condition. It is now over two years since diethylstilbestrol therapy was initiated.

Case iv (M. H. No. 42741). F. F., a female, aged sixty, underwent a left radical mastectomy and a cycle of postoperative roentgentherapy in 1945 in Switzerland. She remained asymptomatic for about two years and then a tender mass appeared on the upper left anterior chest wall just lateral to the manubrium sterni. A biopsy of this mass showed metastatic anaplastic carcinoma. Physical examination failed to reveal any other evidence of disease. The lesion on the chest wall was not treated.

Symptoms of dyspnea appeared in March, 1947. Roentgenograms of the chest showed a collection of pleural fluid on the left side extending as high as the third rib anteriorly and several nodular densities were seen in the right lung field and in the visible portion of the left lung field. These findings were interpreted as cancer metastases to both lungs and left pleura.

Because of progressive dyspnea a left thoracentesis was performed on March 13, 1947, and 1,650 cc. of serosanguineous fluid was removed. The patient experienced temporary relief but the fluid quickly reaccumulated and the resultant dyspnea became so intense that another left thoracentesis was performed one week later at which time 1,250 cc. of serosanguineous fluid was removed.

The patient was given 15 mg. of diethylstilbestrol by mouth daily for a month. Before the end of this period dyspnea had recurred and pain had developed in the lower back. Another left thoracentesis was performed on May 30, 1947, and 1,300 cc. of serosanguineous fluid was removed (Fig. 7). Roentgenograms showed evidence of osteolytic metastasis to the right ilium and to the twelfth dorsal vertebra (Fig. 9).

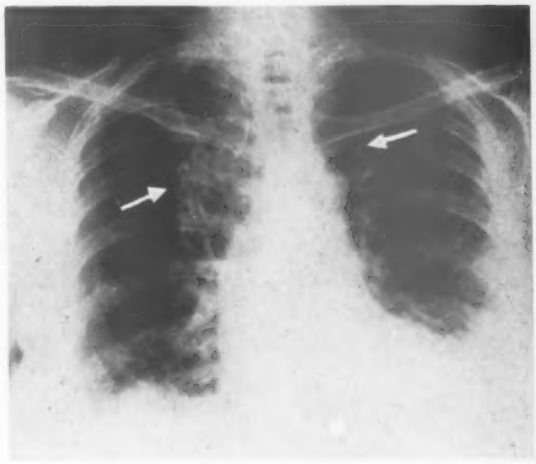

Fig. 5. Case iii. This roentgenogram reveals metastases in both lung fields, more extensive in the right than the left.

Fig. 6. Case iii. This roentgenogram was taken five months after the one shown in the previous figure. In the interval between the roentgenograms, the patient received 450 mg. of diethylstilbestrol. There is considerable regression of the metastases.

Diethylstilbestrol therapy was continued for an additional two months for a total of 1,290 mg. There was no uterine bleeding at any time. The patient gained weight, her general condition improved and she became asymptomatic. She was then discharged from the hospital. She resumed her accustomed domestic and social activities and has remained asymptomatic to the present time, a period of one and one-half years. During this period there has been no reaccumulation of pleural fluid, but the lesion on the chest

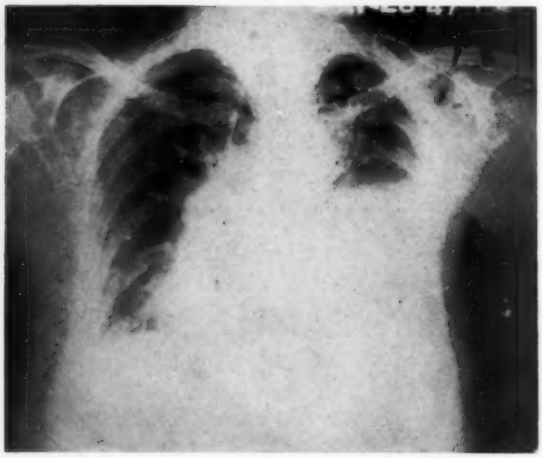

FIG. 7. Case IV. This roentgenogram reveals a large amount of pleural fluid in the left chest and evidence of metastasis in both lung fields. Shortly after this film was taken, 1,300 cc. of serosanguineous fluid was removed from the left chest.

FIG. 8. Case IV. By the time this roentgenogram was taken, seventeen months after that shown in the previous figure, the patient had received 1,290 mg. of diethylstilbestrol. There has been no reaccumulation of fluid and the lung fields have cleared.

wall increased slightly in size. Roentgenograms taken October 15, 1948, revealed absence of pleural fluid, a clearing of the lung fields and a deposition of calcium in the areas of osteolysis in the right iliac bone and twelfth dorsal vertebra (Fig. 8 and 10).

There are some undesirable side effects from estrogenic therapy. Uterine bleeding, in some instances profuse, is induced in many patients. In the 2 cases herein reported the relatively small daily doses of the estrogen (Case III) were associated with uterine bleeding whereas the large daily doses (Case IV) did not produce uterine bleeding. The bleeding ceases after withdrawal of the hormone. Considerable edema of the lower extremities is produced in an occasional case, and in patients with cardiovascular impairment the retention of fluid

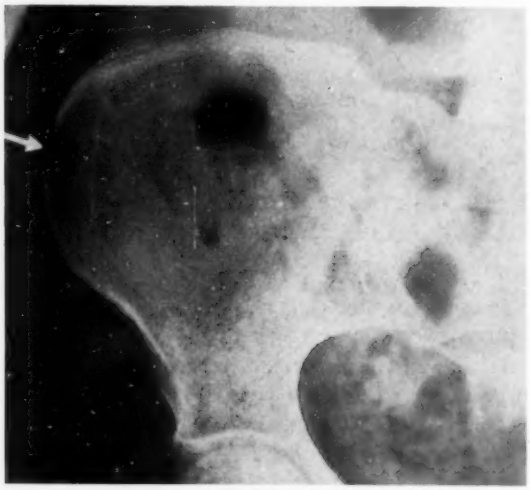

FIG. 9. Case IV. Arrow points to an area of osteolytic metastasis in right ilium.

FIG. 10. Case IV. The osteolytic area shown in the previous figure is now calcified. The interval between the two roentgenograms is seventeen months. The patient had received 1,290 mg. of diethylstilbestrol by the time the second roentgenogram was made.

in the tissues might seriously embarrass the circulation. One patient developed hypercalcemia associated with toxemia and azotemia similar to that described following androgen administration.[23] Usually there is no significant change in the serum calcium or the alkaline phosphatase. A decrease in serum inorganic phosphorus is noted in many patients. This has also been observed in patients with osteoporosis who have received estrogens but the significance of this phenomenon is not at present apparent.[25]

Use of Hormones in Advanced Cancer of the Male Breast. Attempts have been made to induce regressive changes in advanced cancer of the male breast by the administration of the estrogenic hormones. Personal experience has been limited to two patients one of whom was cachectic and bedridden with widespread osteolytic metastases. In this case diethylstilbestrol produced a toxic effect manifested by nausea, vomiting and prostration. There was elevation of the serum calcium and blood urea nitrogen. Some enlargement of the liver was noted although tests revealed no impairment of the liver function. Diethylstilbestrol was withdrawn after one month. The patient's condition continued to deteriorate and emaciation became extreme. The constant, excruciating pain necessitated hypnotics every three hours through the twenty-four hours. Surgical castration was performed and there was an almost immediate improvement manifested by the relief of pain, and later by an increase in appetite and body weight. The patient is asymptomatic and active in his business eight months after castration, although the skeleton is riddled with osteolytic metastases.

The other patient also had widespread osteolytic lesions and failed to respond to estrogenic therapy. He has been castrated recently but it is too early to report significant results.

Abramson and Warshawsky[26] reported the appearance of a cancer of the breast in a man who was receiving diethylstilbestrol for prostatic carcinoma. Marshall and Hare[27] reported the case of a male patient in whom an osteolytic lesion of the ischium secondary to a breast cancer became recalcified with concomitant disappearance of pain solely by the use of diethylstilbestrol. It may be found when more experience has been accumulated that estrogens can be of therapeutic value in selected cases of advanced cancer of the male breast.

CONCLUSIONS

Androgenic and estrogenic treatment of advanced mammary cancer can produce favorable results in many patients. The benefits are manifested by diminution and disappearance of pain and frequently by concomitant regressive changes in the local and metastatic lesions.

Hormonal therapy in common with other therapeutic agents has its limitations and contraindications. If judiciously employed it can be a valuable measure in the treatment of many cases of advanced mammary cancer.

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USE OF ANTICOAGULANT (DICUMAROL) IN PREVENTING POST-IRRADIATION TISSUE CHANGES IN THE HUMAN LUNG*

PRELIMINARY REPORT

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IT HAS been shown by Kaplan and Etkin[4] in cases of carcinoma of the esophagus and carcinoma of the lung that the delivery of 5,500 to 6,500 roentgens to the tumor within a period of four to five weeks was sufficient to completely destroy the tumor. In order to attain this cancerocidal dose at the tumor level it was necessary to employ a multiple portal technique. In spite of complete tumor destruction, proved at autopsy, death occurred shortly in 3 out of 4 of Kaplan and Etkin's cases due to radiation changes in the lungs.

The obvious problem is to eliminate the paradox of successful treatment of the tumor with ultimate death of the patient as a result of secondary changes induced by the treatment itself.

Boys and Harris[1] were able to demonstrate a marked diminution of both gross and microscopic pulmonary changes consequent to irradiation in heparinized rabbits.

It seemed reasonable that the solution of this problem might lie in a combination of these two procedures: delivery of a cancerocidal dose of roentgen radiation and protection by the use of anticoagulant therapy. The basis of this idea is an attempt to prevent the inflammatory changes and fibrin production within the lung, which result in fibrosis, and also to prevent thromboses and fibrosis within the smaller blood vessels of the lungs. Perusal of the literature failed to show any further work in the use of anticoagulants combined with roentgen irradiation in treating cancer in the human.

Although the present case did not survive long enough to enable evaluation of the ultimate effects following a full course of roentgen therapy, certain features were

SUMMARY OF IRRADIATION TO THE TEN PORTALS

Portal No.	No. of Treatments:	Total Roentgens (measured in air)	Total Roentgens (measured on the skin)	Total Roentgens (delivered to the tumor)
1	4	1,350	1,692	393
2	4	1,184	1,632	372
3	3	1,020	1,386	300
4	5	1,550	2,080	295
5	3	1,040	1,378	300
6	4	982	1,205	405
7	4	1,360	1,848	400
8	5	1,790	2,332	342
9	3	1,080	1,362	300
10	3	976	1,332	293
			Grand total	3,400

* From the Department of Radiology, Baltimore City Hospitals, Baltimore, Maryland.

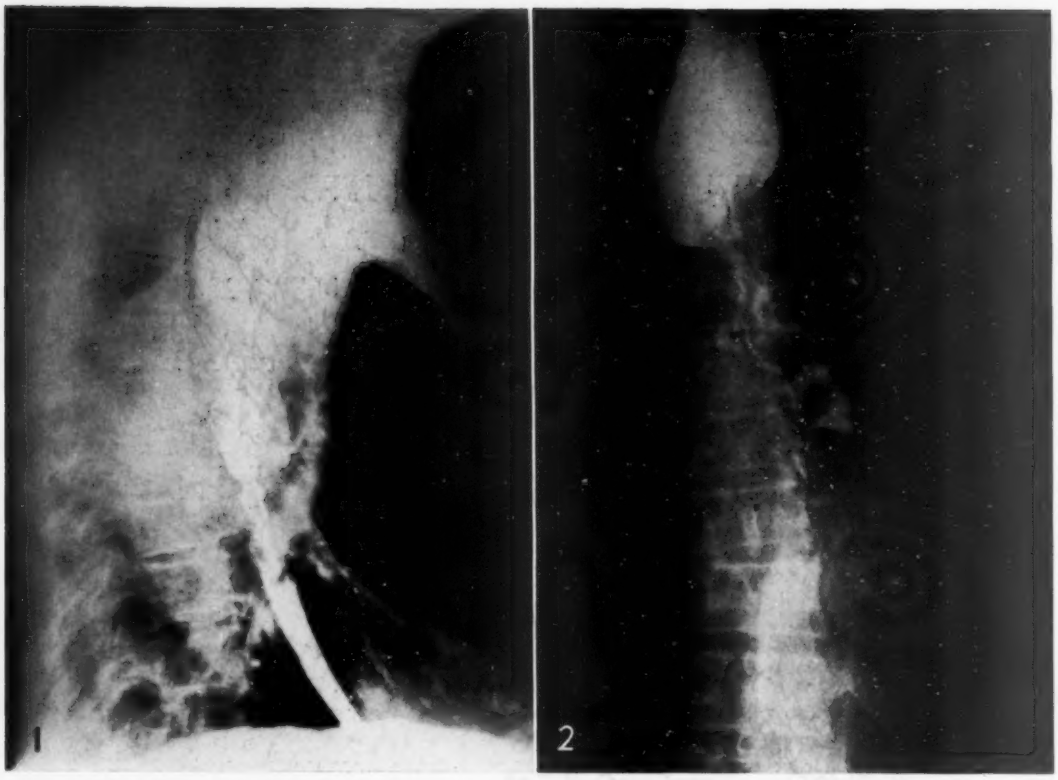

FIG. 1 and 2. Extensive lesion involving middle third of the esophagus (before therapy).

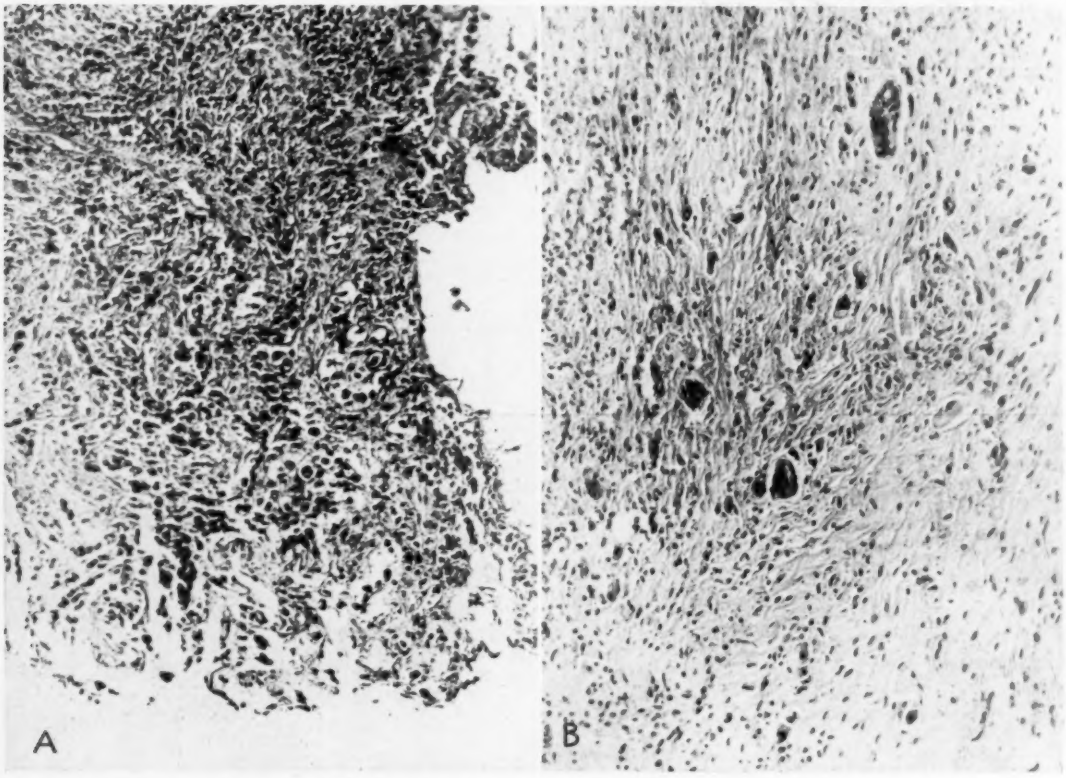

FIG. 3. (*A*) Biopsy (before therapy) shows squamous cell carcinoma. (*B*) Postmortem section shows marked irradiation effect on tumor after administration of only 3,400 r at the tumor level.

Fig. 4, 5, and 6. Outline of portals and photograph of Demy protractor.

encouraging. While the tumor was almost completely eradicated after having received only one-half of the optimum dose, both gross and microscopic examination of the lungs failed to reveal any changes which could be attributed to irradiation. It is therefore considered worth while to report this case in the hope that it will stimulate others who may have access to more cases of cancer of the esophagus in order to apply this new method of therapy for the purpose of proper evaluation.

Because of the economic and other considerations involved in maintaining a suit-

Fig. 7. Re-examination on the seventeenth day of treatment demonstrated a relatively smooth lumen with an esophagobronchial communication.

able increased prothrombin time over a period of weeks, dicumarol was chosen instead of heparin. The use of a long acting anticoagulant such as "Depo-heparin" (Upjohn) may prove even more advantageous in spite of the cost of such material. The modified Quick prothrombin technique was employed using a commercially prepared thromboplastin. An attempt to maintain the prothrombin level between 10 and 30 per cent of the normal was made.

CASE REPORT

H. S., colored, male, aged sixty-four, was admitted because of dysphagia of two months' duration which on admission had progressed to regurgitation even of liquids. There had been marked weight loss. Pain, to the right of the sternum, had been present for several weeks. The voice had become higher and "brassy" in character.

Roentgenoscopic examination showed extensive infiltration of the middle third of the esophagus with incomplete perforation to the left into the para-esophageal tissues. There was dilatation of the esophagus above the site of partial obstruction (Fig. 1 and 2).

Esophagoscopy and biopsy showed the lesion to be a squamous cell carcinoma (Fig. 3). The extent of the lesion and evidence of involvement of the recurrent laryngeal nerve made it inoperable. A gastrostomy was performed and a high protein diet prescribed.

Radiation Therapy. Roentgen therapy as suggested by Kaplan and Etkin was started. Ten portals, each measuring 6.5 by 16 cm., were outlined around the thorax (Fig. 4, 5, and 6). Two opposite portals were irradiated daily to prevent the production of a "hot spot" in the lungs.[4]

The "Demy protractor"[2] was employed to secure a high degree of accuracy in localizing the central beam to the tumor (Fig. 4). A daily tumor dose of 100 r through each of two portals except the two most distant ones (portals 4 and 8) was set as a goal. This neces-

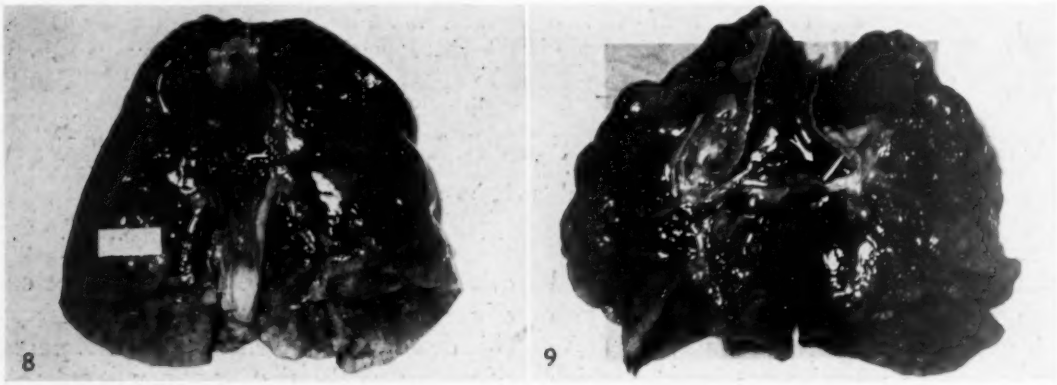

Fig. 8 and 9. Anterior and posterior views of the lungs illustrating slick, glistening pleura. The esophagotracheal fistula is indicated by arrow.

sitated applying as much as 462 r to the skin at one time to the more distant portals. The calibrated physical factors were 200 kv. (peak), added Thoraeus filter, half-value layer of 2.16 mm. Cu, 20 ma., 50 cm. target skin distance (18.5 r per minute, measured in air).

The patient received daily treatments to two portals over a period of seventeen days. Minor symptoms of radiation sickness developed on the sixth treatment day which were relieved by administration of pyridoxine 50 mg. one hour before and one hour after each treatment.

Because of symptoms indicating perforation, the patient was roentgenoscoped on the seventeenth treatment day and a relatively normal mucosa was outlined by lipiodol (Fig. 7). A perforation was demonstrated and the left lower bronchial tree was visualized. The patient died eight days later.

At autopsy the lungs appeared normal under each of the fields of irradiation; there was no evidence of pleural reaction (Fig. 8 and 9). Gross section revealed a patchy bronchopneumonia in the left lower lobe, which the pathologist regarded as terminal. The esophagus was not obstructed. There was an ulceration 12 cm. in length in the middle third, the site of the lesion. The base was discolored and necrotic and the margin sharp and well defined. The central portion of the ulceration communicated with the left main bronchus through an opening of 4 mm. Microscopic study of tissue from the center of the esophageal lesion showed a "maximal radiation effect on the tumor itself in the form of vacuolization, pyknosis and chromatolysis" (Fig. 3*B* and 10). Microscopically there was no evidence of pleural reaction. There

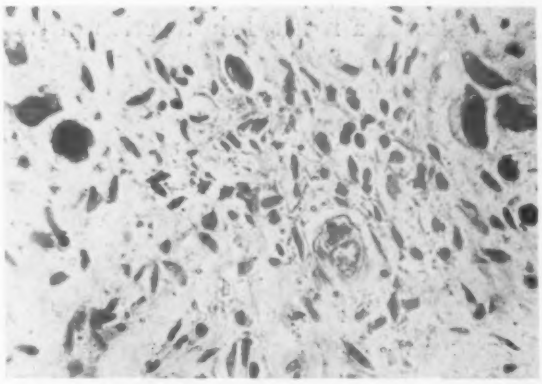

Fig. 10. Microscopic section from the center of the lesion illustrating vacuolization, pyknosis and chromatolysis resulting from irradiation.

was marked inflammatory infiltration of the remaining fibrous stroma of the growth and a few giant sized tumor cells. These occupied the areas formerly filled with tumor cells. These effects of irradiation have been fully described recently by Hall and Friedman.[3]

Microscopic study of sections from the parenchyma at the periphery of the lungs directly under each of the fields of irradiation showed a small amount of terminal pulmonary edema but no thromboses, pulmonary fibrosis, vascular endothelial swelling, or proliferation which could be attributed to irradiation (Fig. 11 and 12).

SUMMARY

A case of inoperable carcinoma of the esophagus in a colored male, aged sixty-four, is reported in which only half of the desired tumor dose was delivered before the patient died. Macroscopic and microscopic

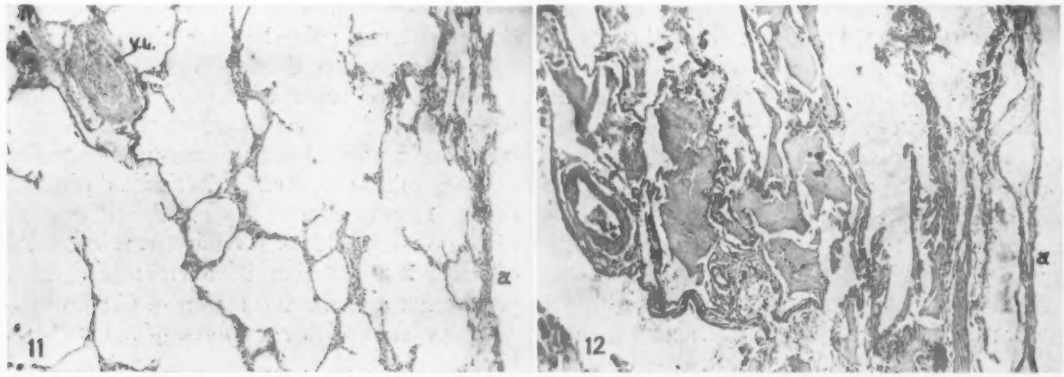

Fig. 11 and 12. Sections from periphery of lung under most heavily irradiated portals 4 and 8 showing absence of irradiation reaction by the pleura (*a*) and endothelial lining of the blood vessels (*V. L.*).

study showed a marked destruction of the tumor in the esophagus without radiation effect on the lungs. It is thought that the period of treatment and the dosage were sufficient to produce some microscopic tissue reaction in the lungs under normal conditions but in this case it is reasonable to attribute the absence of such reaction to the protective influence of dicumarol.

This approach is offered to stimulate others having greater access to cases of carcinoma of the esophagus and lung to apply it for the purpose of proper evaluation. It may offer some hope to that larger proportion of the group which has heretofore been classified as inoperable and hopeless.

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ADDENDUM

Since the submission of the above case report on February 22, 1949, 2 additional cases of carcinoma of the esophagus and 6 cases of carcinoma of the lung have been treated while under dicumarol coverage beginning before and ending after the course of roentgen irradiation.

Each of the cases of carcinoma of the esophagus received a tumor dose of 6,000 roentgens. Repeated roentgen examinations of the esophagus of each of these patients showed a marked response to the irradiation with almost complete healing of the lesions. Roentgenographically the mucosa of the esophagus returned to normal, but there was some residual stenosis present in each case. In spite of this, the patients were able to swallow foods without difficulty. Careful examination of the follow-up films showed no evidence of irradiation reaction in the lung fields. Both cases died after discharge from the hospital and autopsies were not obtained.

Six cases of carcinoma of the lung, all of whom were inoperable, received tumor doses of 5,000 to 8,000 roentgens. These cases were treated through multiple portals ranging from a minimum of seven fields in one case to twelve fields in another, but averaging about ten fields per case. The total skin dose averaged between 20,000 and 22,000 r over ten fields. Five of these cases died of metastatic spread within one to three months after the completion of therapy. They did not show any roentgenographic evidence of radiation pneumonitis at any time during or after the course of therapy. All cases showed a definite decrease in the size of the tumor. Three cases came to autopsy. Microscopic sections showed no evidence of radiation reaction in the alveoli, capillaries or pleura. The sections were taken at the parenchyma of the lungs under the center of each irradiated portal.

The families of the other 2 patients would not grant permission for autopsy. The sixth case is still alive and is in an improved condition one month after the completion of therapy.

One case of carcinoma of the lung was treated in a similar manner with administration of 5,133 r into the tumor. However, this patient was not administered dicumarol. During the course of irradiation, the patient developed a radiation pneumonitis and later at autopsy there was gross and microscopic evidence of pulmonary fibrosis and obliterative fibrous pleuritis attributable to the roentgen therapy.

Certain conclusions have been reached from the experience gained in treating these cases. These may be listed as follows:

1. It is our general impression that administration of dicumarol will prevent radiation reaction in normal lung tissue up to the limits of skin tolerance, i.e., radiation administered through a portal even beyond the point of skin breakdown produces no microscopic evidence of radiation reaction in normal lung at the parenchyma under the center of the portal.

2. Patients with *carcinoma of the esophagus*, both early and late, for whom surgery has nothing to offer and those cases which refuse surgery, have a lesion which will respond to

5,000 roentgens delivered at the tumor. Therefore, this type of therapy should be employed in such cases, preferably using dicumarol.

3. *Carcinoma of the lung* is much more radioresistant than carcinoma of the esophagus. In all of the cases studied, viable appearing tumor cells have been found present even though as much as 8,000 roentgens have been administered to the tumor. The administration of such large doses should be reserved only for those selected few cases which are relatively early but which for some reason may not have the benefit of surgery. The hopeless cases which show definite evidence of metastases to the ribs or other organs should not be subjected to massive doses of radiation but should receive only palliative therapy. Every case in this group, all of whom were hopeless and inoperable, received marked relief from their distressing symptoms of cough, hemoptysis and pain, after the first two weeks of therapy.

4. Patients given dicumarol at the same time as they receive roentgen therapy are extremely difficult to maintain on a constant prothrombin level. Unpredictable responses to relatively small amounts of dicumarol have been observed. In other cases, massive doses of dicumarol have been needed to lengthen the prothrombin time. Patients receiving this type of therapy should be under careful observation in a hospital during the entire course of therapy. The reactions of dicumarolized patients receiving roentgen therapy will be the subject of a subsequent paper.

SUBDURAL HEMATOMA WITH MULTIPLE FRACTURES*

CASE REPORT

By MARCUS J. SMITH, M.D.
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CAFFEY'S report[1] of 6 cases of subdural hematoma associated with multiple long bone fractures has directed attention to the frequency with which these two conditions occur together. The following case report is presented to illustrate this combination.

FIG. 1. Fracture of left ulna and humerus with callus formation and ossifying subperiosteal hemorrhages. These are illustrative of the fractures in the long bones.

CASE REPORT

J. McK. (U. H. No. 786668), a white female, aged four and one-half months, was admitted to the University of Minnesota Hospitals on March 3, 1948. The tentative diagnosis on admission was osteogenesis imperfecta. She was delivered by caesarean section at eight months because of bleeding. Respiration was established with difficulty. Birth weight was 5 pounds 12 ounces, and she was discharged on the eleventh hospital day weighing 5 pounds 2 ounces, apparently in good condition on a similac formula and orange juice. At about six weeks of age the formula was changed to one containing evaporated milk, and 0.5 ounce of "vidaylin" was given daily.

On December 24, 1947, at ten weeks of age, she developed swelling of the right lower extremity and was hospitalized in Seattle where a diagnosis of scurvy was made, and large doses of vitamins C and D were given. Two weeks later swollen areas appeared over the skull and she was rehospitalized and treated with oral and parenteral vitamin C, the latter continued at weekly intervals after discharge. In February, 1948, the left arm became swollen and she was hospitalized in St. Paul, Minnesota. Here roentgenograms showed multiple fractures of the left arm, forearm, skull and right tibia. Physical findings were reported as including brawny hard fusiform swelling of the right leg, generalized edema of the left arm with pain on motion, ecchymosis over the legs and buttocks, and pallor and irritability.

Blood studies showed 9.3 grams hemoglobin, 3.9 million red blood cells and 16,950 white blood cells, with 45 per cent polymorphonuclears and 51 per cent mononuclear leukocytes. Blood level of vitamin C was 1.5 milligrams per cent, calcium 10.4 milligrams per cent and phosphorus 5.9 milligrams per cent. Urine was normal.

The baby was then referred to the University of Minnesota Hospitals for further study. An additional history of repeated attacks of vomiting occurring four weeks earlier was obtained here.

Physical examination revealed a well de-

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veloped and nourished four and one-half month old white female. The circumference of the head was 42 cm. and it was of normal shape. Tension of the anterior fontanelle did not seem increased. Brawny swelling of all extremities was present, as was slight tenderness, but voluntary motion was present. The remainder of the examination was negative.

Blood count was normal. Urine Sulkowich test showed greater turbidity than the control. Blood level of vitamin C was 1.1 mg. per cent, calcium 12.4 mg. per cent, phosphorus 6.4 mg. per cent, and alkaline phosphatase 24.8 King-Armstrong units.

Films of the long bones demonstrated fractures of the left ulna and humerus (Fig. 1), the radius and ulna, the right seventh and left sixth ribs and the skull (Fig. 2). All of these (except the skull) demonstrated considerable callus formation and marked periosteal new bone formation. An unusual ossifying subperiosteal hemorrhage was found in both tibias (Fig. 3).

Because of the similarity of the roentgen findings to the cases reported by Caffey, a subdural tap was performed on March 11, 1948, and 40 cc. of bloody subdural fluid was removed.

Fig. 2. Multiple fractures in the skull. The fragmentation is well shown in this view.

The spinal fluid showed a 700 cell count with 5 per cent polymorphonuclear leukocytes and 95 per cent mononuclear forms, 5.0 grams protein, 62 mg. sugar, and 334,000 red blood cells.

Fig. 3. Ossifying subperiosteal hematoma without apparent fracture. It extends down over the metaphysis. A similar process was present in the other tibia.

Subdural taps were then performed daily during the next two weeks.

On March 24, 1948, bilateral trephine openings were made and the hematomas visualized. A right temporoparietal flap was then turned down and the right hematoma and its membranes were completely removed. The postoperative course was uneventful. Continued aspiration of the left subdural space revealed clear xanthochromic fluid and on April 10, 1948, a similar neurosurgical procedure was carried out on the left side. She was discharged in good condition on April 17, 1948, and seen regularly in the Outpatient Clinic. On June 3, 1948, she was still apparently well except for a cold. Roentgenograms made on that day showed union of all fractures, including the skull, and some residual deformities. The final diagnosis was multiple fractures of the long bones and skull with sudural hematoma.

DISCUSSION

No history of trauma was elicited in this case. However, the patient had made a long trip by train and had been handled by sitters and relatives. Under these circumstances trauma is often denied. Very often the diagnosis of subdural hematoma is extremely difficult to make and, as in the case reported, the history and physical findings are of no value in establishing that diagnosis. For this reason, a knowledge of the association of long bone fractures with subdural hematoma is a real asset to the roentgenologist in aiding the clinician to arrive at the correct diagnosis.

This case differs from Caffey's in the presence of skull fractures, which were not present in his group. The unusual subperiosteal ossification is also notable. This is the first case reported with blood chemistry findings; the alkaline phosphatase is elevated. This is expected in the presence of exuberantly healing fractures and new bone formation.[2] Scurvy was not present at the time of the last admission, being effectively ruled out by the vitamin C level. Rickets and osteogenesis imperfecta were ruled out by the roentgen findings and hyperparathyroidism by the clinical findings.

CONCLUSION

A case is reported in which the presence of multiple fractures of the long bones aided in establishing the diagnosis of subdural hematoma in an infant.

We are grateful to Dr. Charles May for permission to report this case from his Pediatric Service.

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Vol. 63, No. 3

THE "THORACIC WAIST"

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ACCORDING to the textbooks of anatomy, the pairs of ribs become gradually broader from above downwards. The transverse diameter of the rib cage is normally the largest at the level of the ninth rib and decreases from there downwards. Connecting the most lateral (axillary) points of the ribs, a more or less convex outline or smooth curve is obtained and commonly used as the normal diagrammatic contour of the routine thoracic roentgenogram.

This usual description or diagram of the normal bony thorax, however, is incorrect in a great number of cases. The frontal roentgenogram of adults frequently shows a circumscript *inversion* of the lateralward convex thoracic outline. This impression or furrow is a common feature of a great many normal or pathological chest roentgenograms. If the outwardly concave segment is bilateral and of a considerable depth, the double-balloon or bell form of the thorax results. This form is not uncommon, especially in old people. The course of the bony side wall may be described, then, as composed of one and a half period of a sinusoidal curve; one longer outwardly convex phase above, followed by a shorter inwardly convex phase and, finally, a short outwardly convex phase below. This circumscript impression of the lateral chest wall was termed by the writer in a previous paper[3] the *thoracic waist* (lateral thoracic sulcus).

More experience concerning this deformity proved the following:

1. The constriction is commonly found at a constant level, namely, at that of the seventh rib, and reaches its greatest depth at the same level.

2. In many cases the retraction of the ribs presents itself at the middle height of one hemithorax only.

3. The deformity is non-existent in infancy. It starts to develop first in late adolescence, and both its frequency and depth become increased with advancing age.

ROENTGEN FINDINGS

The roentgenologic changes show some gradual differences according to this gradual development and can be classified as follows:

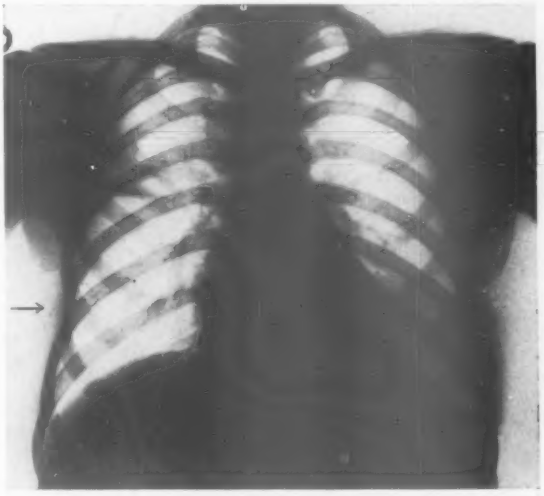


FIG. 1. Slight retraction of the right seventh rib in a male, aged thirty-two. Case of lobular pneumonia of the left lower and right upper lobes.

(1) The deformity starts in a most simple form by changing the regular structure of the juvenile thorax only insofar as

* Fellow of the Dazian Foundation for Medical Research. Work was performed in the Institute for Medical Radiology of the University of Geneva. I must acknowledge my indebtedness to Professor Rene Gilbert, chief, who put the material of this study at my disposal.

† Dr. Polgar died on May 12, 1949. Dr. J. F. Fulton and the Laboratory of Physiology, Yale University, have seen the paper through the press.—Ed.

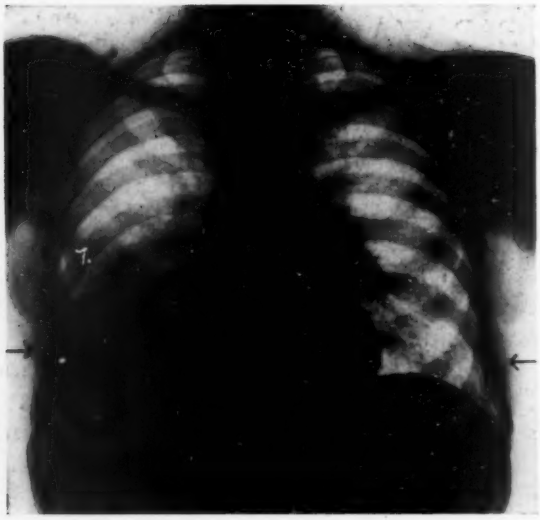


Fig. 2. Thoracic waist with marked retraction of the right seventh rib and corresponding flat impression at the left side in a male, aged fifty-two. The right seventh rib contributes to the demarcation of the bony thorax for a few millimeters only. Case of lobar pneumonia of the right lower lobe.

the seventh—or sometimes the sixth or eighth—ring of ribs becomes unilaterally or bilaterally narrower than the preceding one (Fig. 1, 12, *A-C*). In some cases the gradual widening of the thorax fails to appear in the

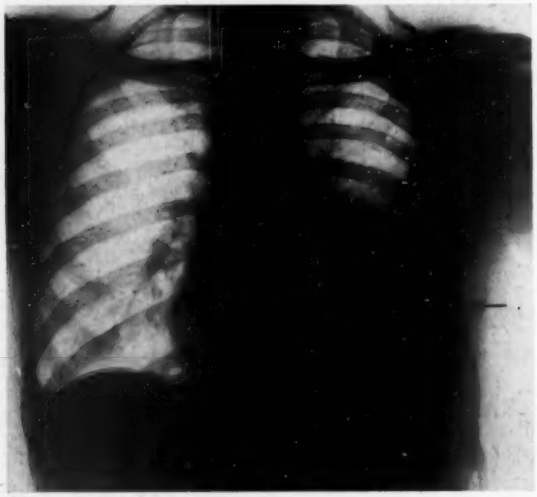


Fig. 3. Hemilateral thoracic waist in a male, aged thirty-two. The outlines of the left seventh and eighth ribs are buried in the shadows of the adjacent ribs. Angular break of the rib wall. Case of left-sided acute pleural effusion with some fluid in the right costophrenic sinus. Dislocation of heart and trachea to the right.

sixth or seventh segment, and the following rib projects laterally by a larger step (Fig. 2, left side). These are borderline cases designated ± in Table 1. They become evident when drawing a tangent to the two most prominent points of the rib arcs above and below.

(2) If the constriction is deeper, an absolutely diagnostic roentgen sign appears, consisting in the retraction of one or more pairs of ribs, which, on the standard dorsoventral film, *do not participate in the lateral*

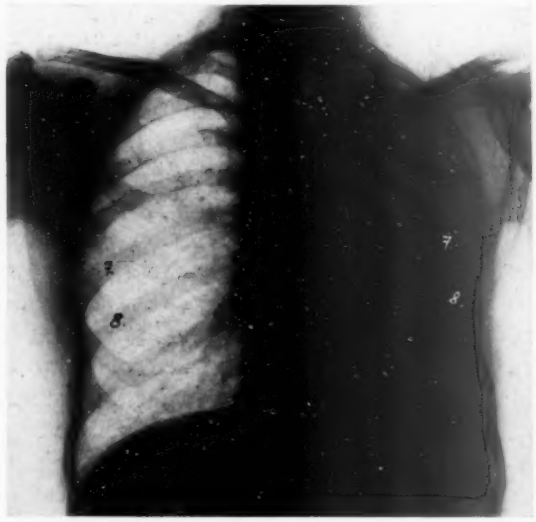


Fig. 4. Bilateral symmetric thoracic waist in a male, aged fifty-six. Marked retraction of the seventh and eighth pairs of ribs. Case of carcinoma of the left main bronchus with atelectatic collapse of the left lung (autopsy).

delineation of the rib cage. The outlines of the retracted ribs are buried in the shadows of the ribs above and below and can only be traced with difficulty (Fig. 2, 3, 5, 12, *D-E*). This is due to the oblique course of the ribs and represents a form of superimposition. If the deformation is small the retracted rib appears uncovered merely for the distance of some millimeters in contrast to the large lateral arcs of the adjacent ribs (Fig. 2, 8, 12, *A-C*).

(3) The constriction may cause an angular break in the course of the lateral rib wall with the point of the angle directed inwardly (Fig. 2, 3, 5, 12 *E*). Two or three

steps of such angulations may appear one below the other (Fig. 10).

(4) In case of pathological changes in the lung fields the constriction of the thoracic waist can easily be misinterpreted as a pathological retraction of the lateral chest wall. The left-sided retraction of the seventh and eighth ribs in Figure 4, for instance, suggests a drawing in of these ribs due to the marked atelectasis of the lung. The completely symmetrical retraction of the corresponding right-sided ribs denotes,

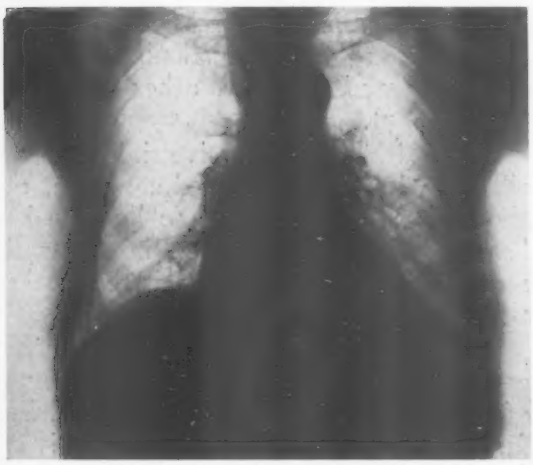


Fig. 5. Angular waist of the right hemithorax and flat impression of the left side in an emphysematous male, aged seventy-seven. Note the drawing in of the overlying soft parts in the region of the retraction of the ribs. Constriction of the intercostal spaces in the middle part of the right hemithorax.

however, the presence of a bilateral symmetrical thoracic waist. Figure 3 shows a similar source of error: the non-participation of the seventh and eighth left ribs in the composition of the side contour is caused by a frequent variation of the hemilateral thoracic waist; it has nothing to do with the pathological change in the lung field (caused, in this case, by acute pleural effusion with dislocation of the heart and trachea).

From the roentgenologic point of view it cannot be too strongly emphasized that the thoracic waist is found in a large percentage (see below) at one side of the chest only. Unilateral cases may show all the varieties

Fig. 6. Asymmetric thoracic waist in an emphysematous male, aged eighty-six. Twisting of the left eighth and ninth ribs as shown by the sudden narrowing of the shaft shadow (arrows) and by a linear crest at the site of the torsion. Drawing in of soft parts at the same place.

from the slight retraction of a single rib to the deep angular break of the outline. The contralateral fellow of the narrowed rib

Fig. 7. Bilateral asymmetric thoracic waist in a scoliotic male, aged eighty-one. Bell-shaped deformity of the right hemithorax. Outwardly concave impression and torsion of the left sixth, seventh and eighth ribs. Case of right-sided lobular pneumonia; calcified lymph nodes in the left supraclavicular field.

Fig. 8. Slight retraction of the right seventh and eighth ribs in a pyknic male, aged fifty-four. Case of atherosclerosis of the aorta and chronic nephritis.

may be completely normal (Fig. 1) or atypical only insofar as its arc takes part in the construction of the wall for a shortened segment only (Fig. 2, 12, *B*).

(5) The soft tissue shadows overlying the constriction may likewise show inward retraction in the form of a "waist" (Fig. 5, 6).

(6) In case of a considerable bilateral drawing in of two or three pairs of ribs the above mentioned double-balloon or bell shape of the thorax results in the seventh pair of ribs being usually constricted the most (Fig. 10). This type of deformation may also be encountered unilaterally (Fig. 11).

(7) Concurrently with the transverse narrowing of the thorax the course of one or more ribs may become suddenly changed, broken in the angular form or *twisted around the long axis of the shaft.* The typical torsion is revealed by an oblique crest-like stripe in the twisted part (Fig. 6, 9). In addition, the shadow of the rib becomes narrower and *more intense,* because the projection is changed and the rays pass through the whole breadth of the shaft (Fig. 6, 7). In old people with senile osteoporosis the convexity of one or more ribs may be impressed at a short portion and changed to an outwardly concave curve at the site of the waist. This concavity is frequently associated with angulation and/or torsion of the axillary parts of the sixth to eighth ribs (Fig. 7).

(8) In the case of a deep impression, circumscript narrowing of the corresponding intercostal spaces occurs, as a rule, and the lateral parts of the involved ribs converge in a fan-like manner toward the deepest point of the furrow (Fig. 5, 10, 12, *D-E*).

(9) In bilateral cases the impression of the right and left chest halves may differ in depth and/or level. Striking asymmetries may develop thereby, particularly in scoliotic individuals, but in other cases also (Fig. 5, 6, 7).

(10) With the progressive sinking of the rib cage in the last decades of life, the thoracic waist may come to lie at a low level when related to the intrathoracic structures, not infrequently at the level of the diaphragm (Fig. 11).

The diagrams (Fig. 12) show the most common types of deformities in the course of the ribs due to the thoracic waist. For further illustrative cases the reader is referred to my previous paper.[3]

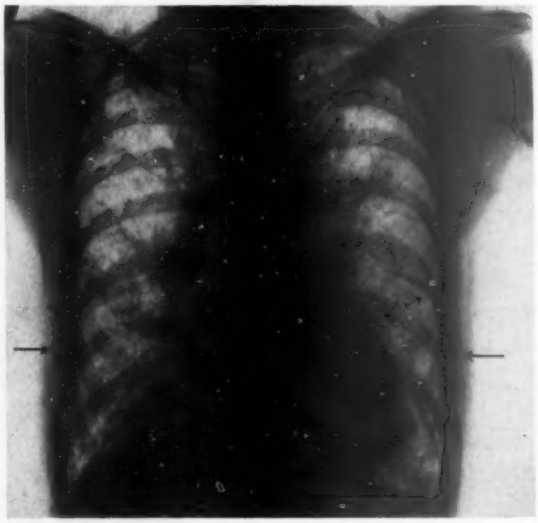


Fig. 9. Bilateral symmetric thoracic waist in a female, aged seventy-nine. The left seventh and eighth ribs are twisted around the long axis of the bone in their axillary parts.

INCIDENCE

In order to evaluate the incidence of the thoracic waist 1,600 routine posteroanterior chest roentgenograms were reviewed in this study. Approximately 200 films were analyzed per life decades without any further distinction, normal and pathological roentgenograms alike.

No positive cases were found in the age group 0–10 (Table I) and only a few in the second decade. The latter is the only group in which unilateral cases outnumbered the bilateral ones.

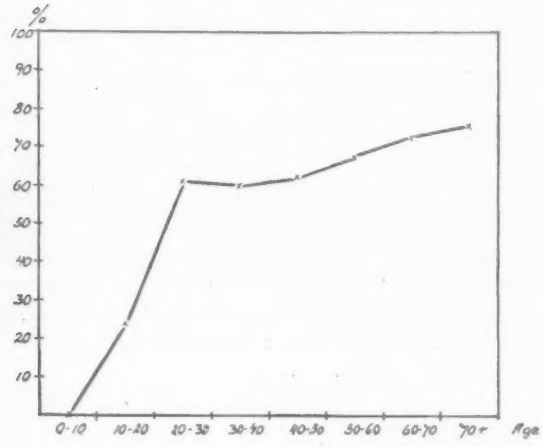
Between twenty and sixty years of age the incidence of the thoracic waist varies but slightly (Graph 1). In old age, however, a definite rise in frequency is evident. Four out of every 5 individuals over seventy years of age have a thoracic waist.

Unilateral cases were found in 20.4 per cent of the whole material (Table II). The

TABLE I

DISTRIBUTION OF ALL CASES ACCORDING TO AGE GROUPS

Age	Number of Cases	Positive		(+) (−)	Negative
		Bilateral	Unilateral		
0–10	188	—	—	2	186
11–20	192	20	29	29	114
21–30	221	88	49	22	62
31–40	208	77	54	10	67
41–50	189	82	42	17	48
51–60	208	98	51	18	41
61–70	198	101	49	12	36
70+	196	106	52	13	25
Total:	1600	572	326	123	579



GRAPH 1. Graph of positive cases.

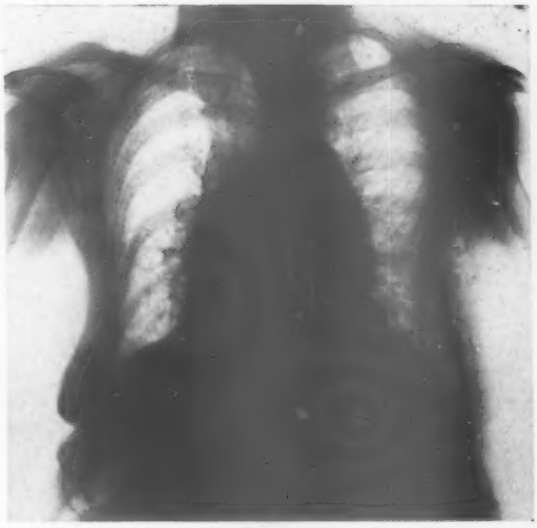


FIG. 10. Thoracic waist with the typical bell-shape of the rib cage in a female, aged eighty-two. Multiple angular break at the left side. Marked narrowing of the intercostal spaces at the level of the waist with convergence of the ribs toward the sulcus.

FIG. 11. Thoracic waist with bell-shaped deformity of the right side in a male, aged sixty-two. Very slight impression at the left side. The concavity of the right side wall is deepest at the level of the diaphragm. Case of syphilitic aortitis with right-sided basal pleural effusion.

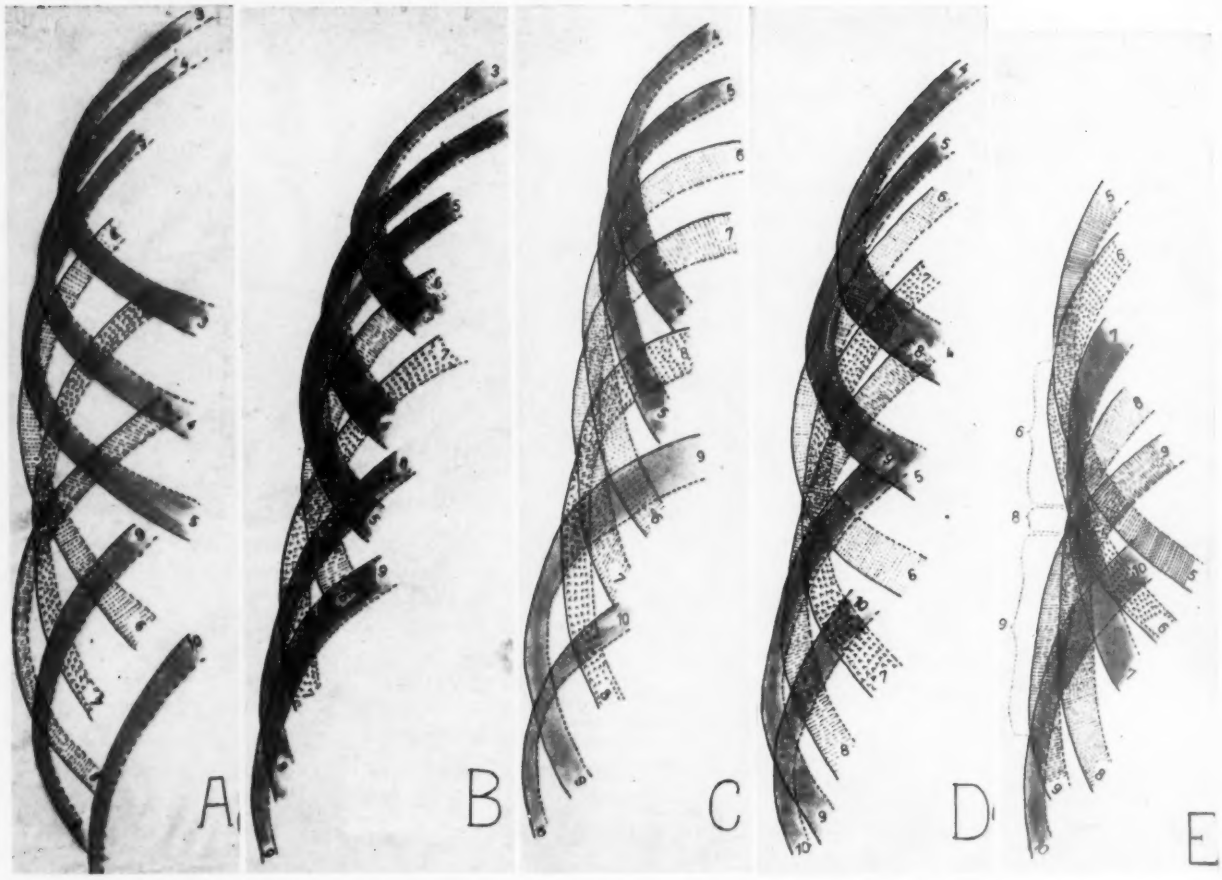


Fig. 12. Diagrams showing some frequent variations of the thoracic waist. (*A*, *B*, *C*) Slight retraction of the seventh, sixth and eighth ribs respectively. (*D*, *E*) Marked retraction of the seventh and eighth ribs with a narrowing of the intercostal spaces and fan-like convergence of the ribs.

right half of the chest was involved two and one-half times more frequently than the left, i.e. out of a total of 326 hemilateral cases 233 (71.5 per cent) pertained to the right side and 93 (28.5 per cent) to the left.

Since the thoracic waist develops first after the completion of skeletal growth, the percentage of its occurrence in adults is of practical significance. As shown in Table II, it amounts from the twentieth year onward to an average of 69.5 per cent. This frequency evidently shows that the thoracic waist is an acquired biological deformity like rigidity of the bony thorax or senile kyphosis and other sequels of the aging process.

The sex distribution was about equal: 56.9 per cent positive cases in males and 55.2 per cent in females in a total of 1,600 cases.

MECHANICAL-ETIOLOGICAL CONSIDERATIONS

As a starting point for a genetic-etiological explanation of the deformity in question the fact may serve that the thoracic waist may be present in healthy persons just as well as in the sick who present all sorts of thoracic disorders. It is a phenomenon of high frequency, increasing in percentage and intensity with age and not observed in childhood. In addition it is less frequent and less marked in the pyknic (Fig. 8). The deeply impressed bell-shaped deformity of the thorax occurs mostly in the longilineal asthenic type, but not in stout individuals.

It follows from the above statistics that

the thoracic waist is to be considered as a *normal* (though not obligate) constructive element of the fully developed bony thorax. This statement is further supported by some drawings in textbooks of anatomy, in which the thoracic waist is correctly reproduced by the unpreoccupied eye of the artist.[3]

Owing to the frequency of the bell-shaped thorax in cases of senile emphysema, the assumption suggests itself to consider the thoracic waist as a peculiarity of the emphysematic rib cage. In my previous paper[3] I described it as a common roentgen sign of emphysema. More experience, however, proved that the high frequency of both emphysema and thoracic waist in the aged is the sole cause of this coincidence. The commencement of the deformation in late adolescence, on the one hand, and its presence in 69.5 per cent of adults, on the other, obviously show that other causative agents must account for it.

In want of postmortem findings and follow-up examinations (which, of course, should be done for decades) only a working hypothesis can be formulated at present. The gradual development and progressive deepening of the thoracic waist in the course of adult life are most readily explained when starting from the biological law of the *pondero-elastic equilibrium*. This law states that, in the upright posture, the elastic structures of the chest function as an *apparatus of support and fixation* in the balance of the weight of the pleuroperitoneal cavity (Polgar[2]). The upright rib cage is more or less loaded and elongated by the weight of the abdominal bag as well as by its self-weight. If man's posture and gait were not upright and his chest were not pulled down by the weight of the trunk, his ribs would not follow an oblique course, but run horizontally, perpendicularly to the axis of the spine, as in the newborn. Besides the bony thorax the thoracic organs are also loaded by the ponderic traction because the weight of the upper abdominal organs is transmitted upon heart and lungs by the mediation of the diaphragm. Owing to this strain, the thoracic organs become likewise distended longitudinally with the body upright.

In comparison with the horizontal position, vertical distention of the upright bony thorax is revealed by the following changes: the intercostal spaces become wider, the course of the ribs is more oblique, the subcostal angle more acute, and the lower thoracic opening becomes constricted and approaches the pelvis. The thoracic suspensory apparatus behaves like a charged coiled spring insofar as the load causes elastic deformation of the rib cage, which acquires thereby a certain amount of potential elastic energy. If the downward traction ceases to act and the coil becomes discharged, as is the case when lying down,

TABLE II

INCIDENCE OF THE THORACIC WAIST IN 1,600 CASES

		All Age Groups				Adults Only	
		Number	Per Cent	Number	Per Cent	Number	Per Cent
Positive	Bilateral	572	35.7	898	56.1	849	69.5
	Unilateral	326*	20.4				
Borderline				123	7.7	92	7.6
Negative				579	36.2	279	22.9
Total:				1600	100	1220	100

* Right-sided: 283 (71.5%).
Left-sided: 93 (28.5%).

this elastic potential changes into kinetic energy and draws the organs back into their original positions, wherefrom they became displaced or distracted down by the vertical ponderic traction.

Between the craniocaudal pull of gravity and the upward elastic counterforce of the chest a state of balance, the pondero-elastic equilibrium, becomes established. It is one of the main biological characteristics of man's erect posture. This balance changes: (a) on every postural change of the body, (b) with age, and (c) with various pathological conditions influencing the elasticity of the thoracic structures.

When charged in the vertical position, the rib cage shows a common mark of elastic distention, viz. the so-called cross-constriction. Like any elastic body distended in one direction, the rib cage becomes constricted perpendicularly to the acting force, i.e. horizontally. This phenomenon can easily be demonstrated by the comparative measuration of the diameters and the circumference of the thoracic outlet in lying and standing. Differences amounting up to 6 cm. can be found in such measurations. This constriction is reversible, provided the rib cage is normally elastic.

Cross-contraction (or "diminution in transverse diameter") of a lengthwise distended coiled spring is uniform if the coils have the same width and the same elastic resistance (same specific elasticity). The rib cage, however, is a very irregularly built coiled spring. Owing to the stiffness of the conjoining breast bone and spine, the elastic resistance of the rings of ribs is less at the side parts, where the high elasticity of the rib can readily be evinced by palpation. This explains why the constriction of the thoracic waist is restricted to the lateral rib parts. Furthermore, regarding their elastic resistance, the rings of ribs differ also according to their level in height. As is known, the superior thoracic opening is a very strong structure. As stated by Keith: "In the human thorax the first pair of ribs and manubrium become more and more welded together to form a single functional structure." Its function is to carry the greatest load and to transmit it upon the spine. The lowest vertebrochondral pairs of ribs, i.e. the ninth and tenth, are likewise stronger and thicker in the adult, especially in their axillary parts, than the preceding ones, probably because of the attachment of the abdominal sac to them. This accounts for the reversibility of their transverse constriction in postural changes.

With regard to these anatomical and mechanical peculiarities of the rib cage, one has to conclude that the diminution in transverse diameter of the thorax, repeated again and again in the upright posture, produces a slowly increasing *irreversible* deformity at the middle height of the thorax, where the elastic resistance of the rib arcs is the smallest. Mechanically speaking, *the thoracic waist is caused by an incomplete elastic recoil of the rib cage* due to the charge and deformation of the thorax by the weight of the upright body cavity.

This explanation is in full agreement with gradual development and progressive deepening of the thoracic waist. It also agrees with the experience that deep constrictions are only found in the asthenic type, but not in broad-chested pyknic individuals. In my opinion, this signifies that the thoracic configuration of the stout type is better fitted to bear and balance the weight of the trunk, because the "coil" of their thoracic suspensory apparatus is shorter and broader.

As stated elsewhere,[2] the human body is not yet fully adapted to the upright posture acquired in the phylogenetical sense not long ago. According to Gegenbaur: "The human body is in the occasional and transitory state of evolution . . . toward more complex and perfect biological states." Search for the sequels of the strain caused by man's erect posture resulted in the establishment of the law of the pondero-elastic equilibrium. As a corollary, this theory made it possible, in turn, to notice and explain the deformity of the thoracic waist, because, to repeat an old truth, we possess and know only what we understand.

SUMMARY

1. In the majority of adults a circumscript retraction of the lateral rib segments can be found at the level of the sixth to eighth ribs. The more or less deep impression or furrow produced thereby is termed the thoracic waist.

2. The deformity starts to develop first at the end of adolescence, and both its frequency and depth increase with age.

3. On the routine dorsoventral chest roentgenogram the most characteristic roentgen sign of the thoracic waist is nonparticipation of one or more retracted ribs in the composition of the lateral margin of the rib cage. Circumscript narrowing of the involved intercostal spaces and torsion of the ribs around their long axis are further symptoms.

4. Unilateral development of the thoracic waist occurs frequently; it must be strictly differentiated from localized pathological retractions of the chest wall.

5. The thoracic waist is explained on the basis of the law of the pondero-elastic equilibrium of the visceral cavity, i.e. the balance between the weight of the trunk and the elastic suspensory apparatus of the thorax. The deformity is caused by the elastic cross-constriction of the erectly carried, loaded and vertically distended thoracic cage. Owing to the phenomenon of incomplete elastic recoil, the constriction becomes irreversible and more marked with advancing age.

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TUBERCULOSIS OF THE RIBS*†

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WHILE tuberculosis of the ribs is rather uncommon, it has been described from time to time in literature, particularly in the past ten years. Thus, Wasserzug, in 1941, stated that over 50 cases had been reported and added 13 more (9 confirmed), out of 1,134 cases of bone and joint tuberculosis seen between 1926 and 1940. Sjövall, in 1946, reported 75 cases treated between 1919 and 1938; he cited König, who had described 110 cases in 1906. Sanchis-Olmas, in 1948, found only 1 case in 428 cases of bone and joint tuberculosis at the New England Peabody Home for Crippled Children.

The present report comprises 6 more cases seen in the past two years and emphasizes some of the diagnostic problems encountered. Only one of the cases was admitted directly to the tuberculosis section; one came first to surgery and the rest to general medicine.

CASE REPORTS

CASE 1. A. L. J., colored, male, aged twenty-two, had been hospitalized for dementia praecox at various institutions since 1943. He was admitted to this hospital on June 20, 1946, with a history of stiffness and painful motion of the neck and slight fever since April and cervical adenopathy since May, 1946. A roentgenogram on April 4, 1946, revealed a mass in the right superior mediastinum (Fig. 1*A*). On May 16, 1946, there was marked destruction of the vertebral border of the left third rib and of the left transverse process of the third dorsal (Fig. 1*B*). In September, 1946, he developed an abscess of the left thigh; and on September 7, 1946, destruction of the right seventh rib, posteriorly, was noted on the roentgenogram.

The biopsy of the cervical gland and guinea pig inoculation of pus from the abscess of the thigh were positive for tuberculosis. (The original report of the biopsy of the neck from another hospital was carcinoma.)

In October, 1946, he developed a slowly pro-

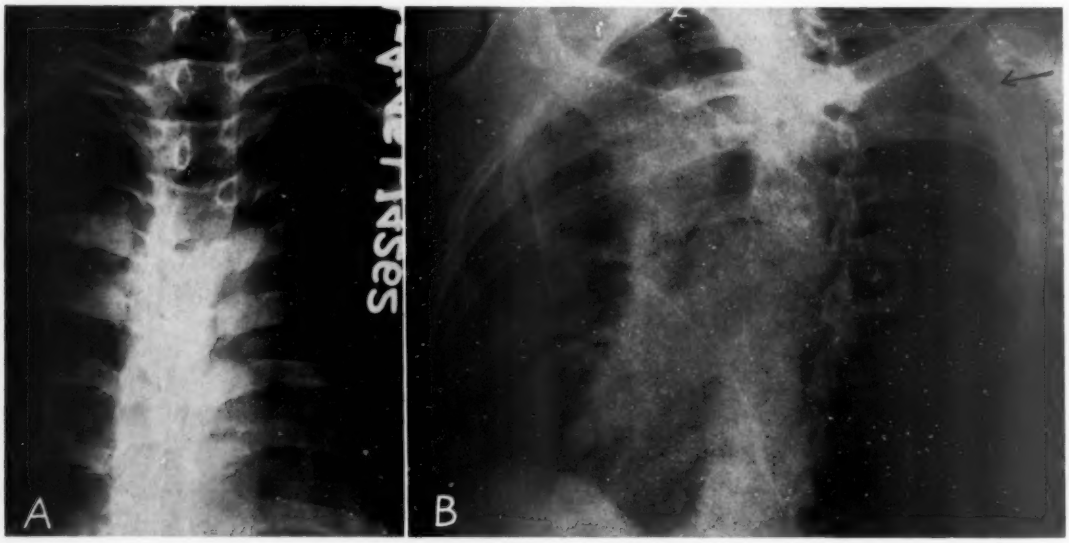

FIG. 1. Case 1. (*A*) April 4, 1946. Mass in right superior mediastinum; no bone destruction. (*B*) May 16, 1946. Marked destruction of the vertebral border of the left third rib.

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gressing swelling of the right side of the neck and on November 5, 1946, progressive paralysis of the arms and weakness of the legs. Roentgenograms then showed anterior dislocation of the first cervical vertebra with destructive changes of the lateral masses of the first and second cervical vertebrae. Paralysis improved on extension with Crutchfield tongs; and the patient appeared to be doing well. On January 22, 1947, however, he began to regurgitate fluid through his mouth and nose; and he died on January 24, 1947.

The autopsy findings were: (1) Tuberculosis of the first and second cervical vertebrae with pathological fracture; (2) tuberculosis of the superior mediastinal lymph nodes; (3) tuberculous abscess with fracture of the left third rib and tuberculosis of the right fifth rib; (4) osteomyelitis of the skull, secondary to the application of the Crutchfield tongs; (5) bronchopneumonia; (6) myocardial degeneration, and (7) passive degeneration of the liver, spleen and kidneys.

Comment. The mass in the mediastinum and the left third rib lesion were considered on roentgen examination to be due to a malignant condition, particularly in view of the original biopsy report of malignancy. Later, however, re-examination of the biopsy slide revealed tuberculosis; and he developed a tuberculous abscess of the left thigh, confirmed by guinea pig inoculation. Then came the destructive changes in the first and second cervical vertebrae with abscess formation and it became evident that the entire process was tuberculous.

Case II. J. L. I., colored, male, aged twenty-six, was admitted on April 1, 1947. In December, 1946, he had "turned" his left ankle and was treated for fracture and osteomyelitis. On admission, there was swelling over the left lateral malleolus, tenderness and fluctuation; motion of the left ankle was limited and painful; and there was left inguinal adenopathy. A roentgenogram of the ankle revealed periostitis and slight destructive changes of the external malleolus. On May 10, 1947, the chest roentgenogram revealed left pleural effusion, crescentic defects in the right sixth rib and left sixth and seventh ribs and an expanding, cystic lesion of the right seventh rib (Fig. 2).

Fig. 2. Case II. May 10, 1947. Left pleural effusion, expanding cystic lesion of the right seventh rib and crescentic defects in the right sixth and left sixth and seventh ribs.

The laboratory findings were: Blood Wassermann and Kahn reactions, negative; red blood cell count, 4,110,000; white blood cell count, 7,200; hemoglobin, 12 grams; sedimentation rate, 28 mm. per hour. One gastric washing on July 10, 1947, and one sputum culture on July 22, 1947, were positive for tubercle bacilli; but numerous other sputa and gastric washings were negative.

On June 23, 1947, a biopsy of the left ankle was positive for tuberculosis. The patient was given streptomycin, 1 gram daily, from July 25, 1947, to November 3, 1947. Draining stopped on October 3, 1947, and on January 23, 1948, the sinus over the left ankle was completely closed. There were no draining sinuses over the chest.

Comment. The onset simulated injury, with secondary osteomyelitis; later, the biopsy from the left ankle was positive for tuberculosis and the patient developed left pleural effusion and destructive changes in the sixth and seventh ribs on both sides, which, undoubtedly, were tuberculous, although no biopsy was done.

Case III. W. L., colored, male, aged twenty-five, was admitted on August 6, 1947, with a history of anorexia for eight months; fatigue,

FIG. 3. Case III. Expanding lesion of the left tenth rib with pathological fracture.

weakness and pain in the right chest and cough for six months; feverishness for five months; swelling of the scalp for four months with a discharge of gray, mucoid material from the scalp for one month; stiffness and pain in the neck for three months; and swelling of the left lower chest for three months.

On physical examination, the head and neck were rigid, the cervical nodes were enlarged and discrete. There were masses in the scalp superiorly, in the parietal region, to the left of the midline, with drainage from the masses. Roentgenograms revealed an expanding lesion of the left tenth rib with pathological fracture and punched-out areas in the left parietal region.

Biopsy of the left tenth rib was positive for tuberculosis on guinea pig inoculation. The tuberculin test was positive in 1 to 1000.

The patient was given streptomycin, 0.5 gram, twice daily, intramuscularly, from October 27, 1947, to February 25, 1948. The sinuses in the scalp closed in twenty-four days, the interscapular swelling disappeared in twenty-one days, and the stiffness in the neck disappeared. The patient was discharged on May 8, 1948.

He returned for examination in June, 1948. Roentgenograms revealed filling-in of the lesions in the skull but a fresh lesion at the base of the right lung.

Comment. In this case, the type of onset and the draining sinuses at once directed attention to tuberculosis. While punched-out lesions of the skull have been described in tuberculosis, it is of interest that one of the lesions was so sharply defined that it resembled a surgical defect.

CASE IV. R. A., colored, male, aged thirty-six, was admitted on February 20, 1948, with a history that in April, 1947, he developed right-sided pleurisy. He was hospitalized at Bath, New York, for seven weeks; and fluid was removed from his chest on one occasion, but the type was not known. He went home, worked for two weeks and then went to Alabama, where he developed pain and swelling on his right side. The swelling was incised by a local doctor, and it continued to drain foul, yellowish-black material, soaking through a medium-sized dressing in twelve hours. He had no cough or hemoptysis; he had night sweats when the pleurisy first occurred, but not since. He had lost 15 pounds in weight, of which he had regained but five.

On examination, there were two fistulous

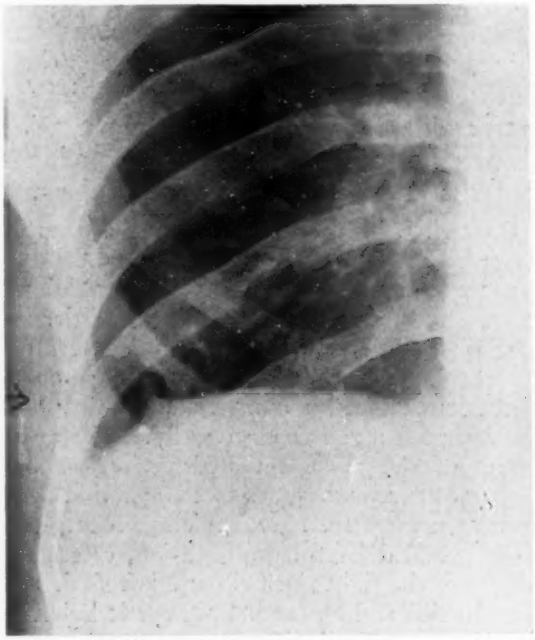

FIG. 4. Case IV. February 24, 1948. Crescentic defect in the right sixth rib.

tracts beneath the right pectoral muscle and he appeared acutely ill. On February 24, 1948, a roentgenogram of the chest revealed a crescentic defect in the right sixth rib.

The laboratory findings were: urine examination and blood chemistry, negative; a smear of the discharge from the chest wall was negative for tuberculosis but contained a few gram positive cocci; a culture showed hemolytic *Staphylococcus aureus;* red blood cell count, 4,130,000; white blood cell count, 5,100; neutrophils, 43 per cent; lymphocytes, 57 per cent; hemoglobin, 13.5 grams; blood Wassermann and Kahn reactions, negative; sputum negative for tubercle bacilli on smear and culture. No fungi were demonstrated in the discharge from the sinus.

On May 11, 1948, the right sixth rib was resected and histopathological examination revealed tuberculosis. The postoperative course was uneventiful and there was no further drainage.

Comment. The rib involvement was most likely secondary to tuberculous pleurisy.

Case v. J. N. S., colored, male, aged twenty-eight, was admitted on August 11, 1947. In February, 1946, he developed a dull, aching pain in the lower dorsal region. This pain persisted with occasional remissions of two or three days. In July, 1947, he developed a sharp pain in the left chest, aggravated by coughing or deep breathing.

Fig. 5. Case v. October 1, 1947. Expanding cystic lesion of the left sixth rib.

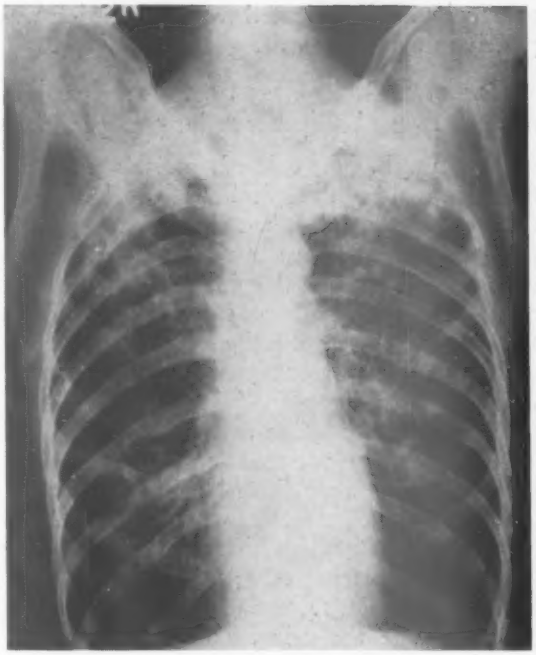

Fig. 6. Case vi. Diffuse tuberculosis of both lungs and multiple destructive lesions of the ribs, both cystic areas and crescentic defects.

Physical examination revealed evidence of fluid in the left chest, but otherwise was negative. A roentgenogram of the chest on August 11, 1947, revealed pleural effusion at the left base and a right mediastinal mass. On October 1, 1947, an expanding, cystic lesion of the left sixth rib was found and on October 6, 1947, pleural effusion at the right base.

The laboratory findings were: blood count, normal; blood Wassermann and Kahn reactions, negative; urinalysis, negative; sedimentation rate, 18 mm. per hour; repeated examinations of the sputum and gastric washings were negative for tubercle bacilli. The tuberculin test was positive in 1 to 1000 dilution.

Resection of the left sixth rib was done on November 26, 1947. Histopathologic examination of this specimen revealed tuberculosis. On February 7, 1948, a destructive process was found involving the anterior border of the sixth dorsal vertebra with slight erosion of the seventh dorsal and a paravertebral abscess in

this region. Pus aspirated from this region was positive for tuberculosis.

Comment. As in Case IV, the rib involvement was probably secondary to pleurisy.

CASE VI. L. M., colored, male, aged fifty-nine. He had been hospitalized from January 9 to February 25, 1947, because of urinary complaints. A roentgenogram of the chest at that time revealed bilateral apical tuberculosis but no rib lesions. He was readmitted on April 20, 1948, with a history of fatigue, malaise, dyspnea and dry cough for one year and considerable weight loss.

Physical examination at that time revealed an acutely ill, emaciated, colored male, and evidence of tuberculosis of both lungs.

The laboratory findings were: red blood cell count, 4,500,000; white blood cell count, 2,500; lymphocytes, 52 per cent; neutrophils, 48 per cent; hemoglobin, 14.5 grams; Bence-Jones protein, found in the urine. Tuberculin test was negative in 1 to 1000. No sputum was obtained because the patient did not raise any sputum and he was too sick to attempt gastric washings.

A roentgenogram of the chest revealed extensive tuberculosis involving both lungs; expanding destructive lesions of the left second and right fourth ribs, anterolaterally: a crescentic defect at the inferior border of the right fifth rib, anteriorly; irregular destruction of the left fourth and fifth ribs, anteriorly; and a pathological fracture of the left seventh rib at the axillary margin. A roentgenogram of the spine revealed a paravertebral mass at the tenth and eleventh dorsal vertebrae with narrowing of the interspace but no bone destruction. Roentgenogram of the skull was negative.

Biopsy of the right fourth rib revealed tuberculosis. The patient died on April 30, 1948.

Comment. The positive Bence-Jones protein in the urine is of particular interest. This test was not repeated, as the patient was only hospitalized for a few days before his death. Kelley and Sailer found Bence-Jones protein on repeated urine specimens in a case of extensive tuberculosis of the skeleton involving many ribs and vertebrae (as well as other bones).

DISCUSSION

The diagnosis of tuberculosis of the ribs presents no great difficulty when other known tuberculous lesions are present. However, unless local swelling calls attention to the ribs, the condition may not be suspected. This is particularly true when only the rib lesion is present. The occurrence of a draining sinus over a rib aids in the diagnosis; but, although sinuses occur often, as pointed out by Wasserzug, they may be absent, as in several of the present cases. Both abscesses and central destruction, without abscess formation, may be present in the same case, as reported by Lyford.

Pathological fractures occur rather uncommonly, but may be multiple, as in a case described by Harris and Coulthard, in which eighteen pathological fractures were found.

Tuberculous, mediastinal lymphadenitis is not an uncommon associated finding. Two of our cases exhibited this finding, one proved by autopsy. In the case described by Kelley and Sailer, the primary lesion was thought to be in the mediastinal nodes.

All of the 6 cases reported here were in male Negroes, although most of our patients are white. In the cases described in the literature, however, white persons were involved quite often. According to Wasserzug, the condition occurs in males three to five times as often as in females; but in Sjövall's series, there were 45 males and 30 females. The condition appears to be more common in adults, but does occur in children. Thus, Wasserzug's youngest patient was three and the oldest, fifty. Sjövall found 45 per cent of his cases to be over forty. Our small series were all adults, the youngest, twenty-two; the oldest, fifty-nine.

Occasionally, Bence-Jones protein is found in the urine associated with multiple, tuberculous, bone lesions. While this has been noted only once (aside from the case reported here) in the articles reviewed by the author, it seems likely that it occurs more often but is not looked for as the lesions bear little resemblance to those of multiple myeloma.

From the roentgenologic standpoint, at

least three types of lesions were seen: (1) an expanding, cyst-like lesion, entirely within the ribs; (2) destruction at the lower border of the rib, and (3) complete destruction resembling a metastatic malignancy.

A positive tuberculin test is suggestive, while a negative tuberculin test, except in terminal cases (e.g. Case 1 in this series), would help to rule out tuberculosis of the ribs. At times, however, biopsy may be required for positive diagnosis.

SUMMARY

1. Three types of tuberculous lesions of the ribs are described, as seen on the roentgenogram: (1) expanding, cyst-like lesion entirely within the rib; (2) destruction at the lower border of the rib, and (3) complete destruction of the rib resembling metastatic malignancy.

2. The occurrence of complications such as pathological fractures, tuberculosis of other bones and occasional tuberculous mediastinal lymphadenitis is noted.

3. Some of the diagnostic problems encountered are illustrated.

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ANGIOCARDIOGRAPHIC OBSERVATIONS OF A PATIENT WITH PRIMARY HEMANGIOSARCOMA OF THE PERICARDIUM

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THIS is a report of the roentgenoscopic, roentgenographic, and angiocardiographic observations of a patient who had primary hemangiosarcoma of the pericardium. So far as is known, this is the first time that an angiocardiographic study demonstrated a filling defect in the heart caused by a primary hemangiosarcoma of the pericardium. Yater[2] (1931) reviewed the literature and found that 46 primary tumors of the heart had been reported and that 10 of them were primary in the pericardium. By 1945, 163 primary tumors of the heart had been reported and of 480,331 autopsies 0.0017 per cent had the condition.[1] A complete report of the clinical, laboratory, and postmortem findings of this case will be made elsewhere.

CASE REPORT

The patient, a white male, aged thirty-six, was employed at a coal mine but was not exposed to coal dust. He felt well until 1946 when he began to complain of weakness and easy fatigability. In February, 1947, he observed swelling of his lower extremities, genitalia, and abdomen. Following rest in bed, these signs and symptoms subsided and the patient returned to work until June 21, 1947, when hemoptysis occurred. The initial roentgenogram of the chest was taken in June, 1947 (Fig. 1). It showed an enlarged heart and discrete nodular densities distributed throughout the lungs.

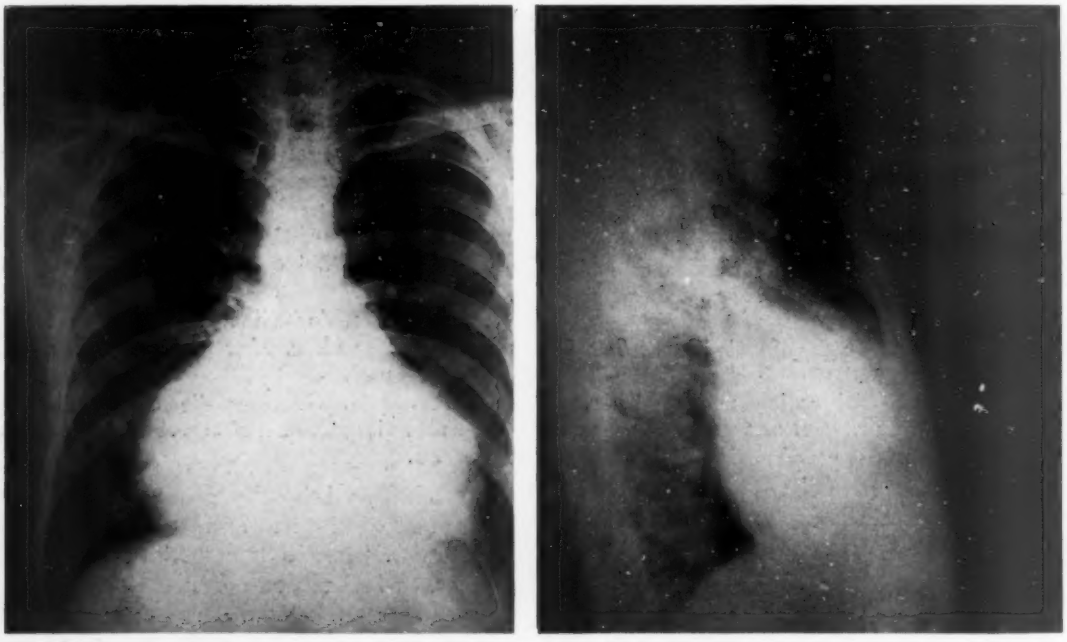

FIG. 1. Posteroanterior and lateral roentgenograms of the chest made in June, 1947, show an enlarged cardiac silhouette and generalized pulmonary infiltration with discrete nodular densities. The lateral roentgenogram shows a clear retrocardiac space.

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Fig. 2. Roentgenogram of the chest made in July, 1947. The heart has increased in size and the nodular densities throughout both lung fields have become more prominent since the previous examination.

He was admitted to Jefferson Hospital on July 10, 1947. His temperature was 99.4° F., pulse rate 100, respiratory rate 22, and blood pressure systolic 112, diastolic 70. The heart was enlarged to the left. The heart sounds were distant; those audible at the mitral area were of greatest intensity. The rate and rhythm were normal and no murmurs were audible. There were dullness to percussion and diminished breath sounds with bronchophony and whispering pectoriloquy over the lower lobe of the right lung posteriorly. The edge of the liver was palpable four fingers below the inferior margin of the right hemithorax. No other physical abnormalities were noted. Subsequently the patient's temperature varied between 98° F. and 100° F. daily; the pulse rate ranged between 100 and 34; the scleras became icteric; the veins of the neck became distended; during systole there was retraction of the left fourth and fifth intercostal spaces in the precordium; and pitting edema of the sacral region, the genitalia,

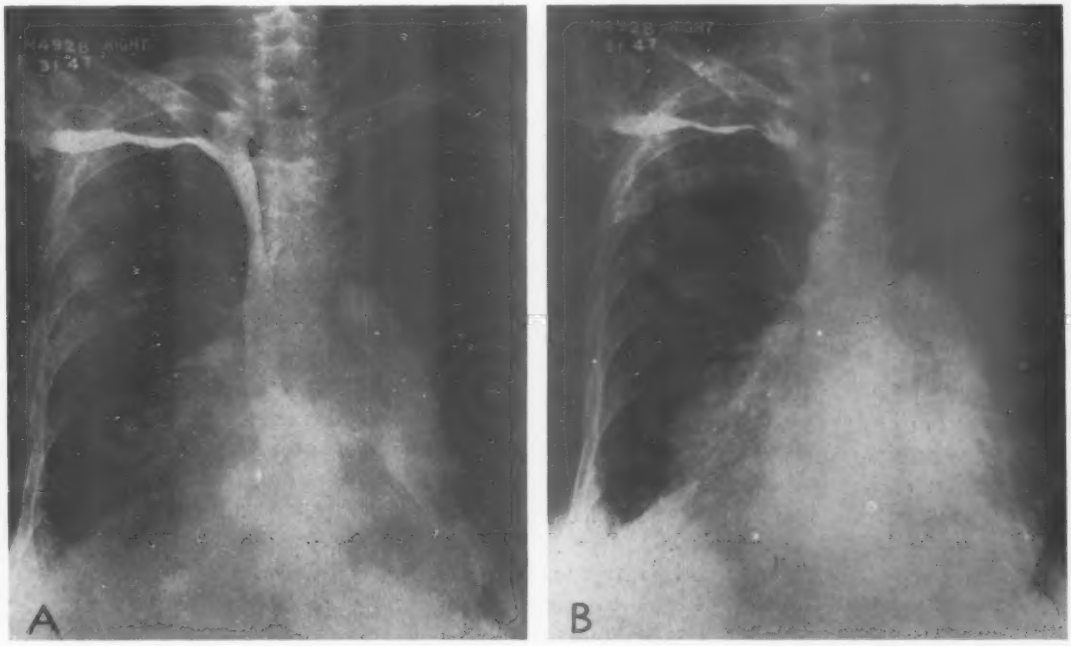

Fig. 3. Angiocardiogram. The pathway of the opaque medium has been outlined in crayon to increase the photographic contrast. (*A*) demonstrates a filling defect in the region of the posterior wall of the right atrium with obstruction to the superior vena cava, delaying the transit time of the opaque medium into the heart. The pulmonary conus and right ventricle are displaced to the left; the pulmonary conus and pulmonary artery are more prominent than normal. (*B*), made approximately one second after (*A*), shows more of the opaque medium in the pulmonary arteries. The nodular densities in the lung fields are not related directly to the vascular bed.

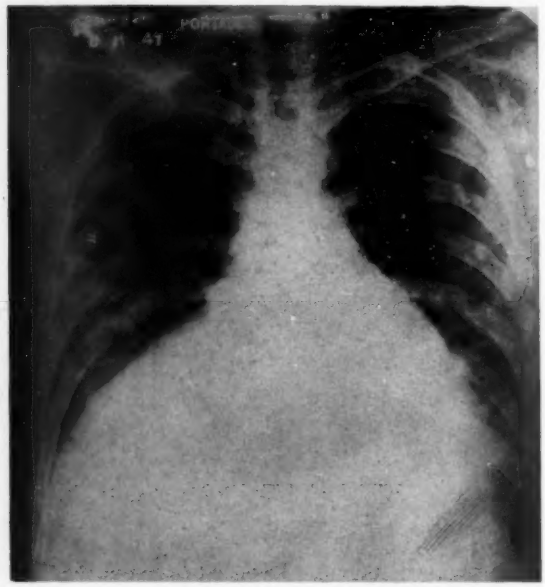

FIG. 4. Roentgenogram made in August, 1947, just prior to the death of the patient, when compared with the one made in June, 1947 (Fig. 1) shows that there is greater enlargement of the heart and the nodular densities in the lungs have increased in size and number.

and the lower extremities was present. The edema of the right lower extremity was greater than the edema of the left lower extremity.

Roentgenograms and roentgenoscopic examinations of the chest were made on July 14, 1947 (Fig. 2). The left border of the heart was observed to pulsate more vigorously than the right border. When the patient was shifted from the erect to the recumbent position the cardiac silhouette did not change in shape. There was enlargement of the left atrium and the left and right ventricle, and many discrete nodular densities were observed scattered throughout both lung fields. Subsequent roentgenoscopic examinations always revealed vigorous pulsation of the left border of the heart whereas weak pulsation or no pulsation of the right side of the heart was observed.

Because the roentgenoscopic and roentgenographic studies were inconclusive as to the nature of the cardiac and pulmonary lesions, an angiocardiogram, using the Robb-Steinberg technique, was made. Two roentgenograms were made approximately two and three seconds after the injection of opaque material into the cephalic vein. A partial obstruction at the junction of the superior vena cava with the right atrium delayed the transit time of the dye into the heart. There was no clear shadow of the right atrium and the small amount of opaque material seen in the right ventricle was displaced to the left (Fig. 3*A*). The pulmonary conus and pulmonary artery were more prominent than normal. The second roentgenogram (Fig. 3*B*) showed that more of the dye had entered the branches of the pulmonary artery, and it was obvious that the shadows in the parenchyma of the lung were not related directly to the vascular bed. The interpretation of the angiocardiogram was:

1. Partial obstruction of the superior vena cava.
2. Normal visualization of the right atrium did not occur.
3. Displacement of the right ventricle to the left and possibly encroachment on its lumen.
4. The densities in the lung fields were not related directly to the vascular bed.

In comparing the roentgenograms of June, 1947, with the roentgenograms taken in August, 1947, it was observed that the nodular densities in the lungs had increased in size and number (Fig. 1 and 4).

Prior to the death of the patient on August 16, 1947, it was thought that he might have a tumor of the heart involving the posterior wall of the right atrium or a plastic tuberculous exudate of the pericardium. The densities in the lungs were thought to be malignant metastases or disseminated tuberculosis. It was believed that if a tumor of the heart were present, it would probably be a metastatic lesion because primary tumors of the heart or its investment are rare.

The postmortem findings were: partial obstruction of the superior vena cava by a tumor; encroachment of the tumor upon the right atrium; invasion of the right ventricle by the tumor, decreasing the size of its lumen. The histopathologic examination was interpreted: primary hemangiosarcoma of the pericardium with metastases to the lungs.

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MALACIA IN TRANSCERVICAL FRACTURES OF THE TALUS*

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FRACTURE through the neck of the talus (astragalus) is a relatively infrequent injury. So-called aseptic necrosis in the body of this bone with subsequent degenerative arthritic change is observed as a sequela quite often, especially when associated with subtalar dislocation. Since the problem is primarily orthopedic, scant attention has been given this lesion in roentgenologic literature during the past twenty-five years. Indeed, the literature in general presents very few accounts and the divergence of opinions recorded as to treatment is quite noteworthy. When the conclusions, however, are finally recorded most of the authors have agreed on the high percentage of poor end results. As sequelae are to be anticipated in a high percentage of cases, it is advisable to re-examine these injuries roentgenologically over a sufficiently long period of time.

It is interesting to note that in World War I as in World War II, transcervical fracture of the talus was quite common in aviation accidents, and that the injury came to be known in 1914 as "aviator's astragalus." Such an injury may be associated with automobile accidents resulting in a crush injury to the talus, or sustained in a fall from a medium height landing on the foot, or following a fall from a horse with the foot fixed in a stirrup. The fracture is usually the result of forced dorsiflexion of the foot, the anteroinferior margin of the tibia assuming the role of the fulcrum causing a simple vertical fracture through the neck of the talus. In the more severe case, rupture of the ligaments occurs and a subtalar dislocation results. Associated fractures may be observed in the anterior tibial margin or adjacent osseous structures. In a small percentage of cases a shearing force may cause the injury since at times necrosis occurs after slight, incompletely crushing trauma (often the initial routine roentgenograms demonstrate no evidence of fracture or dislocation, Fig. 5). All observers agree that a transcervical fracture of the talus is quite comparable to a transcervical fracture of the femur. In addition, we are impressed by the similarity of traumatic malacia in the body of the talus especially with changes in the femoral head in Legg-Calvé-Perthes disease, and to a lesser degree with semilunar malacia of Kienböck.

The vascular supply to the talus (astragalus) is rather poorly demonstrated in the conventional texts on anatomy.[1,3,11] A perusal of several fails to give one the necessary or minute detail to explain the vascular changes under discussion. McKeever[7] demonstrates the intrinsic circulation of the talus in amputated lower legs by injecting a radiopaque solution first into the anterior tibial artery and then into the posterior tibial artery. The venous side is ligated prior to injection. His illustrations demonstrate a branch of the anterior tibial artery going directly to the neck of the talus which undoubtedly supplies its vital blood. The posterior tibial artery by-passes the bone, playing at most a minimal role in its nutrition. Sneed[10] presents essentially the same findings in his illustrations. Lipscomb and Ghormley[6] state that the talus receives blood from the dorsal pedis (a branch of the anterior tibial artery) entering the neck laterally. Watson Jones[4] also shows that the main blood supply enters the neck of the talus. But he identifies large nutrient foramina on the upper and anterior portions of the bone. His diagrams indicate a more generous blood supply than those of other authors. Phemister,[9] in studies of injuries to the talus, indicates that branches

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Fig. 1. Healing fracture through neck of the talus, eight weeks after injury, without malacic change. Note homogeneous osteoporosis of talus and relative density of superimposed fibular malleolus. Clinical result: no pain, no deformity.

along the lateral and inferior junctions of the neck and body supply the bone from the dorsalis pedis artery. From animal studies, he concluded that articular cartilage acts as a barrier to the ingrowth of new blood vessels and that in fractures of the talus, since the intrinsic circulation of the body is sparse, malacic change is apt to occur. He observes that the talus has a very limited number of periosteal surfaces in contrast to its large cartilaginous surfaces (cartilaginous barrier), and consequently very slight fibrous invasion and new bone creeping substitution can occur. He notes also that when the underlying bone undergoes aseptic necrosis, articular cartilage degenerates with subsequent development of arthritis deformans and osteocartilaginous loose bodies. In view of these studies, it is relevant at this point to mention from the clinical aspect that frequent and earlier subtalar arthrodesis would appear indicated as advocated by some orthopedic surgeons, thereby shortening the period of disability and economic loss.

Roentgenographic examination of the ankle and foot at the time of injury reveals the fracture line as a narrow radiolucent band through the neck of the talus. Absence of displacement in the fragments is unusual; dislocation at the posterior compartment of the subtaloid joint should be especially sought. Overlooking a subluxa-

Fig. 2. Transcervical fracture of the talus not united at sixteen weeks. Typical traumatic malacia of the talus with increased density involving the body. Clinical result: (three years) pain; disability; revascularization.

tion is a serious situation since 50 per cent of such cases develop traumatic malacia and permanent crippling of the foot may result. An equinus position of the body may be present. Flake-avulsion fractures in the lower tibia and fractures through the fibular malleolus may be observed as well as tibial malleolar fractures. Gross dorsal displacement of the body is readily recognized, with the body lying on the inner aspect of the tuber calcanei and the fracture surface directed laterally. The anteroposterior and lateral views of the ankle and foot are supplemented at times by a view with the foot in full plantar flexion. Not infrequently, initial routine examination reveals no evidence of fracture, as we have previously stated. When clinical signs and symptoms persist, close contact with the referring physician in such cases is advisable.

At approximately eight weeks, the fracture line in the uncomplicated case usually remains discernible, although it may be completely obliterated. Diffuse osteoporosis is present involving the body and neck of the talus and surrounding bony structure due to their intact circulation. Little or no dislocation is noted (Fig. 1). One might consider these findings as a normal reacting fracture in contrast to the findings which we will now present as sequelae or complications. When "traumatic malacia" of the body develops, roentgenograms in eight weeks or more reveal the body as a dense well calcified structure (Fig. 2). Osteo-

Fig. 3. Non-united fracture of talus eight months after injury. Typical avascular necrosis of the talar body. Severe associated bone injury particularly in the fibula. Clinical results: pain; disability; astragalectomy.

Fig. 4. Non-united fracture of talus eight weeks after injury. Traumatic malacia in body of talus with typical osteoporosis of surrounding structure. Persistent subtalar dislocation associated with torus fracture of lower tibial shaft and flake fracture of calcis. Note normal epiphyseal lines and normal fibular malleolus. Clinical results: (eighteen months) no pain; triple arthrodesis; no disability.

porosis in surrounding osseous structures is dramatically portrayed since their intact circulation has removed almost all the calcium content; whereas the body with its interrupted circulation retains the calcium content present at the time of the injury. The talar fragments in successfully manipulated cases show a relationship to each other and to surrounding structures as would be anticipated in the average normal. In others, however, persistent subluxation or even gross dislocation is observed at this time (Fig. 3 and 4). One must not confuse the malleoli superimposed on the body of the talus as evidence of aseptic necrosis—the normal density of this area always being three times that of adjacent bone. In doubtful cases roentgenograms should be obtained in which no overlapping of bone shadows is present before an opinion is rendered. As is customary in other lesions involving growing epiphyseal bones, views of the normal side should be obtained. Subsequently revascularization

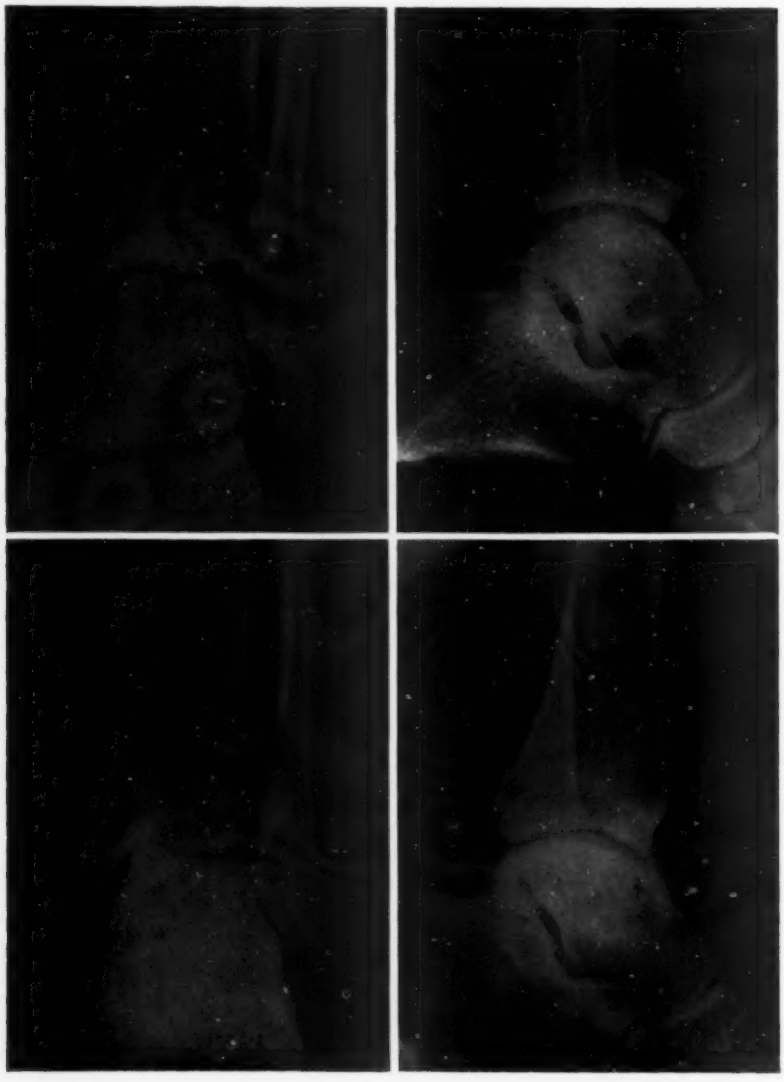

Fig. 5. Talus immediately following a fall on icy pavement. No discernible fracture. No supplemental views obtained (above). Same case three years later showing malacia and deformity of the talus (below). Clinical result: pain; weakness; disability.

(Fig. 2) may occur and seems dependent upon immediate reduction and accurate approximation of fragments, immobilization in plaster and protection from weight bearing for many, many months. The time interval is apparently shortened somewhat by early subtalar arthrodesis as previously noted. In this respect, Phemister has observed that, if fractures unite and dead bone is protected from stress and strain, e.g. from weight bearing, it may gradually be replaced by new bone and fairly satisfactorily functioning structures may be obtained. These observations are especially pertinent in fractures of the talus where the structures involved are similar to the structures involved in the Legg-Calvé-Perthes disease, both conditions warranting prolonged protection from weight bearing in non-operative cases.

COMMENT

Attention is again directed to the role the roentgenologist must assume in the prevention of crippling disability following fractures of the talus. Malacia should be anticipated in the body of the talus following injury to this bone and sufficient re-examinations made in order to discover the malacic body early. This is especially indicated in cases associated with subtaloid dislocation. These frequent re-examinations will aid in the prevention of premature use of the extremity.

CONCLUSIONS

1. The body of the talus (astragalus) contains an extremely poor intrinsic circulation.

2. Traumatic malacia (aseptic necrosis) will occur in 50 per cent or more of fractures through the neck of the talus with subtaloid (subastragaloid) dislocation.

3. The demonstration of devitalization in the body as early as possible is necessary for adequate orthopedic treatment which can lessen the number of crippling disabilities.

4. Typical roentgenographic findings of this entity are presented.

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OSTEITIS PUBIS

REVIEW OF THE LITERATURE AND REPORT OF A CASE

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BEYOND the specialists in urology it is not well known that trauma over the pubis may be followed by a non-suppurative self limited destructive process in this bone whose features suggest an aseptic disease due to the mechanical irritation of trauma, or an atypical osteomyelitis from a low grade infection.[4,10] This disease known as osteitis pubis to the urologists has been described by them as occurring in 3 per cent of the cases of elderly men following suprapubic prostatectomy.[5]

The urologists regard this disease as a definite and important clinical entity with characteristic signs, symptoms and clinical course, in which the roentgenographic appearances are of major diagnostic significance. Consequently, the roentgenologist should be familiar with this condition, especially in order to avoid unnecessary surgery, and in order to prevent confusion with common osteomyelitis and malignancy;[8] however, no mention of it could be found in any of the standard textbooks of roentgenology, and no cases were found reported in any of the journals of roentgenology.

INCIDENCE

Beer[2] reported the first case of this disease in 1924, and since that time up to 1948, 45 additional cases have been reported in the literature. Out of these 45 cases, 41 have been in elderly men following suprapubic prostatectomy. For many years it was believed that this disease occurred only in elderly men following the trauma of this operation. Barnes,[1] however, in 1933 reported 1 case in an elderly man following perineal prostatectomy, and Wilensky[11] reported 2 cases in women following childbirth. Kleinberg[6] reported another case in a woman complicating a pyelonephritis, and in the same report devoted one sentence to mentioning that typical cases have followed a hernia operation, a prostatic abscess and occupational trauma to the lower abdomen. Very likely this condition is considerably more frequent than indicated by the number of cases reported. Many mild cases undoubtedly occur without a physician being consulted, while other cases remain undiagnosed or are diagnosed and not reported.

Recently I observed a typical case of osteitis pubis in a boy, aged sixteen, following a contusion of the lower abdomen. This case is reported in the succeeding paragraphs. A search of the literature revealed that this is the first case of this disease reported in a young person, the first case in which the disease followed a single direct blow over the pubis without a preceding surgical operation, and the fifth case not following suprapubic prostatectomy.

CASE REPORT

White male school boy, height 180 cm., weight 70 kg., aged sixteen, without significant prior illness, on January 2, 1946, struck his abdomen a hard blow over the symphysis and right pubis against the hip of an opponent while playing basketball. In spite of suffering considerable pain in the injured region, he continued the game. By the following day, the pain had decreased considerably. An examination at this time by the team physician disclosed moderate soft tissue swelling over the symphysis and right pubis. The overlying skin was unbroken, but was slightly discolored yellow. Palpation revealed a slight increase of local temperature and slight tenderness. Hot moist compresses and limitation of physical activity were advised, while attendance at school was permitted. By the fifth day after the injury, the boy felt completely well, and all traces of the injury had disappeared from the lower abdomen. Up to January 23, 1946, the boy felt completely well, attended school and engaged in his usual physical activities.

On January 23, 1946, however, he started to experience moderate boring pain in the region of his symphysis and right pubis, made worse by walking and sitting, while rest in bed almost completely relieved the discomfort. Since the pain continued to increase in severity, and walking and sitting became increasingly more difficult, he consulted his family physician on January 26, 1946. In the examination at this time the physician noted a pulse of 88 and a temperature of 100.8° F. Slight soft tissue swelling, slight increase of local warmth and considerable tenderness were present over the symphysis and right pubis. Deep palpation disclosed no fluctuation characteristic of pus. A blood count on January 26, 1946, showed 9,200 white blood cells with 72 per cent polymorphonuclears. Kahn test and urine examinations were negative.

Fig. 1. January 26, 1946 Roentgenogram of pelvis twenty-one days after injury showing spotty destruction of right pubis most marked about symphysis and superior ramus, the region of greatest trauma. Clinically, there was a slight fever and no evidence of pus.

A roentgenographic examination on January 26, 1946, showed demineralization and a spotty type of destruction of the right pubis most marked about the symphysis and involving the greater portions of the superior and inferior rami and extending into the inferior ramus of the ischium. There was slight periosteal new bone formation and no evidence of sequestrum or surrounding soft tissue mass or calcification (Fig. 1).

Rest in bed for a three week period was advised. During this rest period the pain gradually became less severe, swelling and tenderness disappeared, and the temperature and blood count returned to normal.

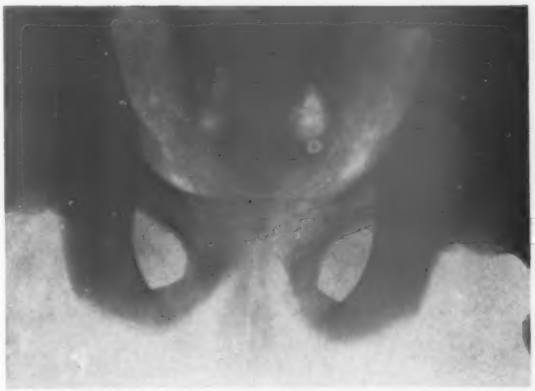

Fig. 2. February 19, 1946. Roentgenogram of pelvis forty-four days after injury showing increase in the amount of bone destruction. Clinically, the patient was almost well. Without the clinical findings, the disease at this stage might easily be confused with malignancy.

On February 19, 1946, the patient was allowed to return to school feeling almost completely free of pain, and was able to walk and stoop with very little discomfort. A second roentgenographic examination at this time revealed slightly more periosteal new bone and more bone destruction than was present at the examination of January 26, 1946 (Fig. 2). The patient, however, continued to improve and felt perfectly well and able to resume all of his former activities by March 12, 1946. A roentgenographic examination at this time now

Fig. 3. March 12, 1946. Roentgenogram of pelvis sixty-six days after injury showing replacement of the destroyed bone by normal bone. Note the absence of sequestra, a conspicuous feature of this disease.

showed the region of destroyed bone being replaced by normal bone (Fig. 3). Since then up to the time of his last examination on February 5, 1948, the patient has continued to feel well, with repeated roentgenographic examinations showing a gradual replacement of the destroyed bone by normal bone (Fig. 4).

Fig. 4. February 8, 1948. Roentgenogram of pelvis approximately two years after injury showing almost complete restoration of the bony contours of the pubis. As residue, occasionally the symphysis may remain widened or fused.

DISCUSSION

Diagnosis. The diagnosis in this case, as well as in those cases reported in the literature, was based upon the history of trauma, the signs, symptoms, clinical course and roentgenographic appearance. Without the roentgenographic appearance of bone destruction, the disease can be confused with inflammation of the prevesical space. Without the history, signs, symptoms and clinical course, the roentgenographic appearances, especially early in the disease, can be confused with common osteomyelitis or malignancy.[7]

Clinical Course. The clinical course in this case was that of the classical case. Two to six weeks following trauma to the pubis, pain and tenderness appear in the injured region associated with slight fever, leukocytosis and roentgenographic evidence of bone destruction. During a subsequent period of two to six weeks rest in bed, the disease gradually subsides without pus or fistula formation so that the patient is clinically well within two to six months.[9]

Roentgenographic Appearances. In this case bone destruction was most marked in the region of greatest trauma. This is the rule. Occasionally in an early case clinical signs and symptoms may be present before the roentgenogram shows any abnormality.[8] Later in the course of the disease, as in this case, the roentgenogram may show marked evidence of bone destruction with periosteal new bone formation, while the patient shows little or no clinical evidence of disease. Bone destruction and new bone formation take place at the same time. In the early stages, bone destruction predominates. In the later stages, new bone formation predominates and progresses over six months to two years until the contours of the bone are restored to normal.[3] There is no evidence of bone cavitation, sequestrum, soft tissue mass or soft tissue calcification at any time. In this case the bony contours were practically normal in appearance within a period of two years. Occasionally as the only lasting residue of the disease, there may remain some roughening or spurring of the bone contours, or the pubic symphysis may remain widened or fused.[6]

Prognosis. In this case the boy has remained entirely well since March 12, 1946, up to February 5, 1948, the time of his last examination. In all cases the prognosis is excellent.[9]

Treatment. Rest in bed and time proved most effective in this case. This is the rule. Surgery is contraindicated. Penicillin, sulfa drugs,[3] roentgen therapy, leg traction and body casts[8] have been tried without evidence of benefit.

SUMMARY

1. Although osteitis pubis should be of considerable interest to the roentgenologist, very little has been written concerning it in the roentgenological literature. Therefore, the literature is reviewed and those features of the disease most likely to be of

interest to the roentgenologist are outlined.

2. A case with the typical signs, symptoms, clinical course and roentgenographic appearances of this disease is reported. This case, however, differs in two important particulars from those previously reported: namely (1) it is the first case reported in a young person, (2) it is the first case reported without a preceding operation in which the disease followed a single direct blow over the pubis.

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ROENTGENOLOGY AS A MEANS OF INSTRUCTION IN ANATOMY IN NORTH AMERICAN MEDICAL SCHOOLS*

A SURVEY OF METHODS AND EQUIPMENT AT WASHINGTON UNIVERSITY AND EIGHTY-FIVE OTHER SCHOOLS OF MEDICINE

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THE rationale of teaching normal roentgen-ray anatomy to the medical student early in his career is logical and easily explained. Although a few schools do not teach roentgen anatomy in the preclinical years for one reason and another, the great majority of medical schools are including more and more such instruction as part of the first or second year anatomy courses. Most medical faculties today realize that every physician, regardless of his specialty, is expected to have at least a working knowledge of roentgenology. To this end more courses in clinical roentgenology are being presented. Films of pathological cases are also being utilized in the other clinical specialty classes to an increasing extent.

All too often, however, the junior or senior student is thrown into the study of pathological changes as seen in roentgenograms without any adequate preliminary study of the normal. Inasmuch as pathological changes are recognizable only in direct contrast to a knowledge of the normal, it is self evident that any well taught course in normal roentgen anatomy in the preclinical years is of inestimable value.

Hickey[5] in 1926 and Bardeen[2] in 1927 were among the first to point out the value of close cooperation between the roentgenologist and the anatomist on the medical faculty and to urge a frequent use of films and roentgenoscopy in the teaching of gross anatomy.

The roentgenological approach to the study of "living" human anatomy is of value in furnishing a contrast to the cadaver. It draws attention to structural differences, both internal and external, between individuals and to variations present in the same individual in different positions and under varying conditions. The correlation of the roentgen appearance of anatomical structures with the impressions gained from dissection and external examination exerts an important influence on the outlook of the student. Instruction in roentgen anatomy, if properly and systematically presented, will impress the students with the wide applications of the anatomical subject matter they are learning. Some will be stimulated to more careful observation, deduction and research.

The presence of clinical roentgenologists as instructors in any program of teaching roentgen anatomy or of utilizing roentgen rays in gross anatomy instruction is of three-fold importance: (1) The freshman student has the advantage of having an instructor aware of the importance and applications of anatomy in clinical medicine, and aware of the potential value of the roentgen ray in anatomical study and research. (2) The instructor gains a new and intimate knowledge of human anatomy in-

* Presented at the Sixty-second Meeting of American Association of Anatomists, Philadelphia, Pa., April 13, 14 and 15, 1949.

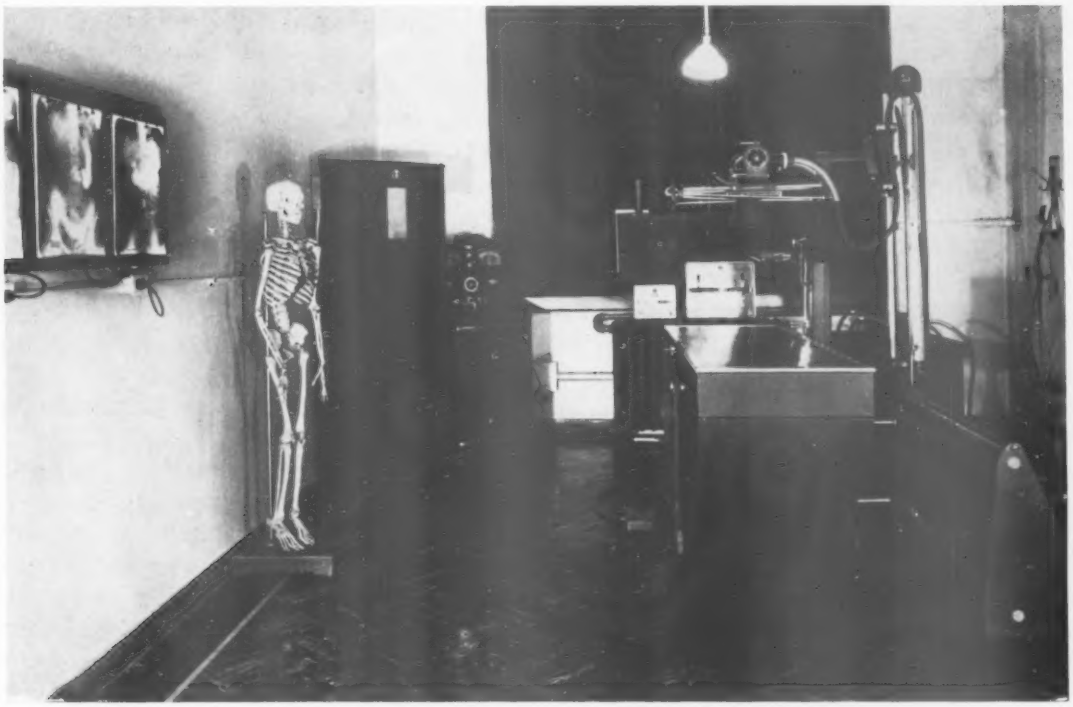

Fig. 1. Roentgenologic equipment for teaching and research in the Department of Anatomy at Washington University in St. Louis.

dispensable in the practice of his specialty. (3) The co-instructorship thus set up opens the way to more complete cooperation between the departments of radiology and anatomy with all the fascinating avenues of research and exchange of information implicit in such an arrangement. Any arrangement involving clinical roentgenologists in teaching anatomy will not be an unqualified success, however, if the roentgenologist is not truly interested in anatomy.

Adequate roentgen equipment is indispensable to a complete presentation of normal roentgen anatomy no matter who presents the material to the student. A complete diagnostic roentgenologic unit is desirable but not essential. A fluoroscope, multiple view-boxes, and complete film files are essential.

The course in anatomy for freshmen at Washington University in St. Louis has featured the extensive use of roentgenological principles and equipment in the elucidation of anatomical facts for several years. In the last three years the part-time employment of clinical roentgenologists as prosectors, laboratory instructors, and demonstrators in anatomy has been added to make the instruction in roentgen anatomy more comprehensive. In addition complete modern diagnostic roentgenologic equipment has been purchased and installed on the premises of the Department of Anatomy. This includes a shockproof, two-tube, tilt-table unit of 200 ma., 100 kv. capacity; a darkroom, and multiple view-boxes (Fig. 1).

Two resident physicians, in training as radiologists, are assigned by the Professor of Radiology as instructors in roentgen anatomy at the beginning of each academic year. During the time which they spend in anatomy department, they are under the direction of the Professor of Gross Anatomy and work with the personnel of that department.

Each of these instructors spends twelve hours per week for six months in the anatomy laboratory. Approximately fifty hours

are used in formal film and roentgenoscopic demonstrations to groups of eight or ten students. The demonstrations are scheduled for the period just before the examinations on the preceding dissection. Five questions in roentgen anatomy are usually included in each practical examination. Time not spent in demonstrations and prosector work is utilized in explanation of details and clarification of fine points in roentgen anatomy to individual interested students.

For the film demonstrations a large and comprehensive file of roentgenograms is available. An effort is made to include roentgenograms of all parts of the body at representative ages, portraying the normal, usual variations, and developmental anomalies. In addition, special roentgen diagnostic procedures are utilized to delineate the normal anatomy of structures not readily demonstrated in plain films: e.g., bronchograms, cardioangiograms, cerebral arteriograms, pyelograms, venograms, pneumoencephalograms, myelograms, gastrointestinal series, laminagrams and injected specimen films are demonstrated and discussed. The film file is in a constant state of revision and addition.

During the roentgenoscopic demonstrations the mechanics of the joints are demonstrated in a graphic manner possible in no other way. The gastrointestinal tract and its contours and motilities in the living are outlined by means of barium meals administered to members of each student group. Cardiac contours, relations, excursions, and variations are shown and discussed. Respiratory movements and the relations of the lungs, diaphragm and bony thorax receive a comprehensive treatment.

During the course of the year, usually in the early part, several lectures are presented touching on the fundamentals of technique, roentgen optics, the objectives of the course, and the future clinical value of the information to be presented. No effort is made to emphasize the clinical aspect of the subject matter, however, and it is discussed only as an occasional added item for the interest of the student.

No official text is required of the students but several excellent books are recommended for study and reference. "Surface and Radiological Anatomy"[1] is well written and illustrated and is found to be of considerable value. "Pediatric X-ray Diagnosis"[4] contains many excellent passages on the normal roentgen anatomy of the child. "Radiology for Medical Students"[6] is recommended for the fundamentals of roentgen optics, physics, and principles of diagnosis. In addition these books, if purchased, will serve the student as reference works in later years.

The following five points are present in what we consider an ideal program for teaching normal roentgen anatomy in conjunction with gross anatomy to the preclinical student: (1) adequate roentgenologic equipment and film files; (2) well correlated program of film and roentgenoscopic demonstrations and illustrated lectures; (3) full cooperation of the anatomy and radiology departments in a teaching and research program; (4) clinical roentgenologists as instructors in the anatomy laboratory and class-room; (5) a separate course in normal roentgen anatomy if time permits. One or more of these points are precluded in many schools by the elements of time, finances, and didactic policy. Two-year schools seldom have a separate department of radiology.

In an effort to determine the extent and type of the use of roentgenology as a means of instruction in anatomy, questionnaires were mailed to the professors of anatomy of eighty-nine American and Canadian medical schools with inquiries relative to the five points listed above. A similar questionnaire was sent to fifty-five schools in 1947. The replies to both inquiries are combined and presented below. Three schools are not included in the final summary. This survey brings up to date information contained in a paper by Pendergrass[8] in 1938.

The schools which are included are rated from o to ++++ according to the number of points of the ideal their courses

in anatomy fulfill. The ratings, of course, apply only to the degree of use made of roentgenology in anatomy and not in any way do they reflect on the excellence of the departments concerned. Considerable estimation and interpolation were necessary, and some unavoidable errors of rating were certainly made in the classification of so many schools. We hope that no serious errors are present and apologize for any injustices that may have been done.

Of the schools covered by the survey, only the University of Oklahoma School of Medicine meets all five points of the ideal. Ernest Lachmann, Professor of Anatomy at that institution, has outlined his teaching methods and the objectives of the course in an excellent paper[7] published in 1940. Vermont does not fall in this category with Oklahoma only because no roentgenologic equipment except view-boxes is available in the department of anatomy. A separate course in surface and roentgen anatomy lasting one and one-half semesters is presented during the second year.

Fifteen schools (17.4 per cent) fall into the ++++ category.

CANADA

Toronto — Western Ontario

UNITED STATES

Chicago Medical College	Minnesota	Washington (St. Louis)
Dartmouth	Pennsylvania	Washington (Seattle)
Hahnemann	Stanford	Western Reserve
Illinois	Tennessee	
Jefferson	Vermont	

All of these schools presented evidence of extensive use of roentgen rays in teaching anatomy, close cooperation between the departments of radiology and anatomy, adequate roentgenologic equipment available either in the department or nearby, and inclusive film files. The programs at Jefferson and Pennsylvania are most similar to that at Washington University.

Stanford University assigns a practicing radiologist as a part-time instructor (two hours per day, three days per week) to anatomy where he presents film and roentgenoscopic demonstrations and aids in correlating the gross dissection with the roentgen findings. In addition each student receives a set of roentgenograms for independent study at the time the skeleton is issued.

The forms which cooperation between the two departments of instruction takes are varied. The existence of co-instructorships is common as is the assignment of resident personnel in radiology to the department of anatomy. If time permits, the benefit accruing to the residents in the latter type of plan makes its employment worth while. Provision of films and equipment by the radiology department for the use of the anatomists and the exchange of facilities between the two departments are almost universal forms of cooperation.

The remaining schools are classified as follows: Twenty-six (30 per cent) as +++.

CANADA

Dalhousie — Manitoba — McGill

UNITED STATES

Arkansas	Nebraska	South Dakota
California	New York University	St. Louis University
Chicago	North Carolina	Temple
College of Med. Evang.	Ohio	Texas
Cornell	Pittsburgh	Wisconsin
Louisville	Rochester	Woman's Medical College
Loyola	Southwestern	
Marquette	Southern California	
Michigan		

Of these schools, California, Chicago, Dalhousie, St. Louis, Michigan, Wisconsin, and Woman's Medical College of Pennsylvania do not fall in a higher category only because no clinical radiologists are associated with the department of anatomy as instructors. Walter Sullivan, Professor of Anatomy at Wisconsin, is a pioneer in the use of roentgen rays in anatomy and is considered an authority in this field. Dr. Sullivan is responsible in a large measure for the improvement of this method of instruction at Washington University.

Twelve Schools (14 per cent) are rated ++.

Boston	Long Island	North Dakota
Columbia	Missouri	Oregon
Creighton	New York Medical College	Syracuse
Duke		Utah
Harvard		

Of this group, Duke and Harvard are difficult to classify. Duke University has a co-instructorship in radiology and anatomy and carries out a carefully integrated program in roentgen demonstration of morphological anatomy with films only. Roentgenoscopy is used in the physiology department. Harvard presents a series of fourteen lecture-demonstrations in roentgen anatomy by members of the radiology department to first year students as well as displays of pertinent films in the dissecting laboratory.

Sixteen schools (18.6 per cent) are rated +.

CANADA		
Queen's	Laval	Saskatchewan
UNITED STATES		
Baylor	Iowa	West Virginia
Buffalo	Johns Hopkins	Yale
Colorado	Tufts	
Emory	Medical College of Virginia	
George Washington		
Indiana	Virginia	

Queen's University has a much more complete program in the planning stage.

Eight schools (9.3 per cent) are rated o+. In this category fall the schools which have no planned program of instruction in roentgen anatomy but use roentgen rays occasionally in anatomy laboratory and lecture room.

Alabama	Louisiana	Vanderbilt
Bowman-Gray	Mississippi	Wayne
Kansas	Tulane	

Wayne University is planning to increase its program materially by the addition of complete diagnostic roentgen equipment and is negotiating for the assignment of a resident in radiology as instructor in roentgen anatomy.

Eight schools (9.3 per cent) are rated o.

CANADA		
Alberta	Montreal	
UNITED STATES		
Albany	Georgia	Northwestern
Cincinnati	Maryland	South Carolina

Cincinnati University's plans for correlation of roentgen anatomy and gross anatomy were interrupted by the death of the head of the department. At the Medical College of the State of South Carolina plans are made for a program of film and roentgenoscopic demonstration and equipment has been purchased but its use has not begun yet.

Three schools are not included by reason of not replying to the questionnaire.

Georgetown	Howard	Meharry

As might be expected, lack of time and/or money was advanced most often as the reason for employing roentgenology only occasionally or not at all in anatomy. Several heads of departments, however, replied that they did not recognize the value of such instruction. One school (Northwestern) discontinued its use this year in anatomy but employs roentgenograms in an applied anatomy course conducted by the department of surgery. The two-year schools are handicapped by the absence of a department of radiology in most cases, but some of them have enlisted the aid of local radiologists in their teaching programs.

SUMMARY

A résumé of the extent and type of use of roentgenology as a means of instruction in gross anatomy in eighty-six American and Canadian schools of medicine is presented. Only three American schools are not included in the survey. Particular attention is paid to the methods in use at Washington University in St. Louis.

Seventy-eight (90.7 per cent) of the schools included make some use of roentgenology in the course in gross anatomy. The use varies from frequent, extensive, and comprehensive in forty-two schools through lesser degrees of use in the remainder. The anatomy departments of only eight schools make no use of roentgen methods or equipment at all.

The methods used for exhibition of anatomical parts as visualized by the roentgen ray vary from plain roentgenograms

through all the special procedures of roentgenology, to injected specimens, lantern slides, and balopticon projections of textbook illustrations. Roentgenoscopy is an important part of the instruction technique in all but four of the forty-two schools making extensive use of roentgenology and is employed in many of the less extensive programs as well. All or part of the instruction is given by clinical roentgenologists in fifty-nine schools.

Cooperation between the departments of radiology and anatomy is evident in most schools in the form of exchange of instructors and consultants, equipment and research materials.

In general, normal roentgen anatomy is taught during the freshman anatomy course and supplemented by review in the third or fourth year clinical roentgenology classes. Illustrated lectures to the entire class, and film and roentgenoscopic demonstrations to groups of eight to ten students are the usual teaching methods.

The authors' viewpoint is well summarized by a quotation from a paper by Batson[3]: "The ideal situation will be realized when the anatomist and the roentgenologist are intimate conferes and when everywhere there are radiologic as well as dissecting facilities in the anatomical laboratory."

COMMENTS

Dr. J. E. Markee, Duke University: "We feel very strongly that the morphological aspects that can be portrayed on film should be taught in connection with gross anatomy and that the functional studies should be coupled with physiology rather than with anatomy."

Dr. Melvin H. Knisely, Medical College of the State of South Carolina: " . . . students should know a considerable amount of normal x-ray material as a foundation, so that they can begin to recognize pathology when present."

Dr. Eduard Uhlenhuth, University of Maryland: " . . . if the facilities are available such a course in x-ray anatomy should constitute an optional course. We do not have the facilities . . . and consequently I have decided to abstain from giving it."

Dr. W. L. Hard, University of South Dakota: "The Department of Anatomy is very much interested in increasing the correlation of anatomy and radiology in its application to diagnosis."

Dr. Barry J. Anson, Northwestern University: "Our fluoroscopic apparatus, used in former years, has been removed; all laboratory time is now devoted to dissection."

Dr. W. J. Hamilton, Charing Cross Hospital Medical School (University of London): "A number of my colleagues and I feel very strongly that the radiological appearance of the skeleton at different ages should be taught to the students during the period they are in the anatomy department."

Dr. John F. Huber, Temple University: "We feel that it is very satisfactory to correlate the roentgen anatomy with the dissection."

Dr. Walter E. Sullivan, University of Wisconsin: "Our idea of the matter is that it (normal roentgen anatomy) should not replace the cadaver but supplement it."

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FACTORS IN GLOBULE FORMATION WITH PANTOPAQUE MYELOGRAPHY*

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WE RECENTLY became disturbed by the number of cases we had in which the pantopaque broke up into droplets or globules in myelography. This interfered with diagnostic accuracy and we set about to determine what were the factors causing it (Fig. 1).

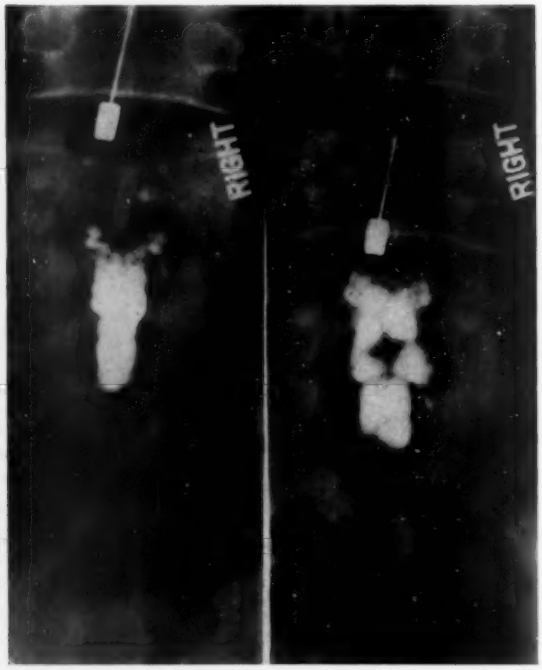

FIG. 1. Example of marked globule formation in a broad canal. This patient had a midline herniated nucleus pulposus with extension to the right at L5-S1.

In a review of the last 127 cases done in the past ten months we found 22 in which the oil broke up. All of these cases were those in which 3 cc. of pantopaque was used.

We correlated these cases with the different lots of pantopaque received and found no apparent difference in the quality of the oil. In a further attempt to control all factors we instituted certain measures for uniform instillation of the opaque oil and taking of the spot roentgenograms.

They are as follows: .

1. Warming of the oil immediately before injection.
2. Allowing at least two minutes for the injection
3 Tilting the patient slowly so that the opaque oil sticks together.
4. Making the spot films in roentgenoscopy rapidly before emulsification can take place.

Table 1 shows the 127 cases tabulated. In 61 cases 6 cc. of pantopaque was used. Twenty-two of these canals were broad, 31 were average and 8 were narrow. In none of these cases did the pantopaque break up into globules.

In 66 cases, 3 cc. of pantopaque was used. Of these, 24 were broad, 32 were average and 10 were narrow width canals. Twenty-two of these, or one-third, showed a slight, moderate or marked break-up of the oil. All of these neural canals were either broad or average in width. Of the broad canals, 5 showed a slight, 2 showed a moderate and 2 showed a marked break-up of the oil. Of the average width canals,7 showed a slight, 5 showed a moderate and 2 showed a marked break-up.

Following the present measures of warming the pantopaque, etc., reduced the incidence of break-up. But in average and broad canals using 3 cc. of opaque oil there

* From the Department of Radiology, Franklin Hospital, San Francisco, California.

Table I

		Myelogram Using 6 cc.				Myelogram Using 3 cc.			
		Canals				Canals			
		Broad	Average	Narrow		Broad	Average	Narrow	
		22	31	8	61	24	32	10	66
Pantopaque break-up	Slight	0	0	0		5	7	0	
	Moderate	0	0	0		2	5	0	
	Marked	0	0	0	0	2	2	0	22

is still globule formation, especially if there are defects in the canal across which the pantopaque cascades as it travels up and down. Present experience and an analysis of our figures has convinced us that if the neural canal is wide, more than 3 cc. will be necessary for good demonstration of the entire canal. Very occasionally small lesions will be obscured by a large amount of oil. If the patient is tilted and the canal re-examined during the withdrawal these small lesions will readily be discovered.

Many radiologists and neurosurgeons routinely use 6 cc. or even more regardless of the width of the canal. We now begin with 3 cc. of pantopaque and add a second or third ampule of 3 cc. if this seems necessary.

SUMMARY

1. Of the 61 myelograms using 6 cc. of pantopaque, there were no cases of break-up of the pantopaque into globules.

2. Of 66 myelograms using 3 cc. of pantopaque, there were 22 cases with break-up of the oil.

3. All of these 22 cases were neural canals of broad or average width.

4. Warming the pantopaque, injecting it slowly and taking the spot roentgenograms without delay helped to reduce the incidence of break-up.

5. Additional amounts of pantopaque are used in wide canals.

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THE EFFECT OF RADIOACTIVE PHOSPHORUS ON THE GROWTH OF THE ALBINO RAT*†

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INTRODUCTION

SOON after the introduction of radiophosphorus in the treatment of patients by the Department of Radiology at Temple University, in the Spring of 1944, three children were presented for therapy with acute lymphatic leukemia. Although the drug was ineffective, and the three patients died of the disease, the problem of the possible late effects of P^{32} in children was considered. This was particularly pressing not only because of the known effects of roentgen rays and radium on the epiphyses of children, but because of the high uptake of P^{32} by bone as shown by Lawrence,[5] Erf[2] and Warren.[8] This experiment was set up, therefore, in an attempt to observe the effect of P^{32} on growth.

Cohn and Greenberg[1] determined that 20–25 per cent of absorbed P^{32} was concentrated in the rat femur within four hours. This dropped to 15 per cent in 150 hours. In 1939, Manly and Bale[6] again demonstrated the rapid uptake of P^{32} by the long bones of the fore and hindlegs of rats. They found a 6 per cent uptake in four hours, increasing to 9 per cent in two days. They also demonstrated that more than twice the amount of P^{32} was found in the epiphysis at the end of the first day than in the diaphysis, and the amount increased up to seven days after the injection of a single dose of the radioactive material. Between the seventh and thirteenth day, the P^{32} moved out of the epiphyseal area. The concentration in this area now approximated that in the diaphysis, which had remained nearly constant throughout the entire period.

Hinkel,[4] utilizing the work of Haas,[3] determined that 73 per cent of the growth in the rat femur occurred at the distal femoral epiphysis. Following irradiation, he found that stunting or permanent cessation of growth could be caused and that disproportionately larger doses were necessary to inhibit growth in older animals.

Our object then was to determine the effects of P^{32} on the general growth of the animal as determined by its weight, the effect on the growth of the rat femur, and to establish a schedule of dosage for this laboratory animal.

PROCEDURE

Wistar Institute white male rats were used. One hundred and forty were received at twenty-one days of age, the weaning age. One group of 24 were established as controls. The remaining animals were divided into four groups of 24 rats each, and one group of 20 rats. These latter five groups received P^{32} on the following basis: Group A (24 rats) 44 μc/kg., Group B (24 rats) 132 μc/kg., Group C (24 rats) 400 μc/kg., Group D (24 rats) 1,200 μc/kg., and Group E (20 rats) 3,600 μc/kg.

One hundred and sixteen adolescent rats were received at forty-two days of age. These were divided as those above into four groups of 24 each, and one of 20, and labelled Group A, Group B, etc. The corresponding groups of forty-two day old animals received the same doses of P^{32} as described for the twenty-one day old rats.

Having no standard of dosage of P^{32} for rats, an arbitrary dosage of 400 μc. per kilogram per month was taken as a basis for assigning the material to the animals. This dosage was used as a hypothetical average

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† Thesis submitted in partial fulfillment of requirements for the degree of Master of Science (Radiology), Temple University Medical School, June, 1948.

rat dose, and spread from 44 μc/kg. to 3,600 μc/kg., using multiples of three. Four injections were given to each animal, except the controls, at weekly intervals. Each injection amounted to one-fourth of the total dose, adjusted to the weight of the individual animal at the time of injection.

In order to determine the possible effect of different concentrations of P^{32}, each group, except Group E, was split into divisions of 12 animals each. One division known as "high" received the P^{32} from the stock bottle after neutralization. The "low" division rats received the same amount of P^{32} solution diluted with NaH_2PO_4/Na_2HPO_4 in an 8:2 ratio. This made a phosphate solution buffered to a pH approximating 7.4. Thus the "low" divisions received solutions of P^{32} which contained enough buffer to furnish 100 times the amount of inert phosphate present in the P^{32} stock solution administered to the high divison rats.

The rats were weighed on receipt and were given their first dose of P^{32} by subcutaneous injection in the belly. They were weighed again before each subsequent weekly administration of the drug.

On receipt and at monthly intervals the femoral lengths were ascertained by roentgenographing the rats in the supine position and measuring the roentgenograms with dividers. Weights were taken on the day the roentgenogram was taken. The twenty-one day old animals were roentgenographed at 21, 28, 56, 84, and 112 days. The forty-two day old rats were roentgenographed at approximately 42, 56, 84, and 112 days. All animals surviving, were roentgenographed at approximately 300 days.

Bakelite animal boards were used and the animals were anesthetized with subcutaneous nembutal and held outstretched by means of clips and strings. The boards were placed on cardboard holders. A rotating anode tube was employed using a fine focal spot at a distance of 79 inches to make any distortion negligible. The factors were 50 kv., 100 ma., and 0.75 sec.

Autopsies were performed on one animal from each group including the controls on the day that the roentgenograms were made.

THREE WEEK OLD RATS

Wide variations occurred in the weights and femoral lengths of the rats as obtained from the Wistar Institute. Several observations were made on a study of these weights and lengths which indicated a need for adjustment. Tables I and II show the distribution of the animals in their respective groups according to weight and femoral length. It is to be remembered that the animals were assigned to their groups on a chance basis (chronologically as received). There was high correlation between weight and femoral length in these animals. Those having the longest femurs weighed the most. It was noted that in the control group rats weighing less than 30 grams at twenty-one days remained smaller throughout the period of observation; their weight at 112 days averaging approximately 12 grams less than that of the animals which weighed more than 30 grams at twenty-one days. The same findings occurred in femoral lengths up to the eighty-fourth day, although in the last month of observation, animals which started with femurs measuring less than 16 mm. did attain slightly greater final lengths. To adjust for these differences in the initial weights as observed in the control group, the combined weight of the animals in any group or part of a group was considered to equal 100 grams, and all calculations were then based on weight per 100 rat grams at twenty-one days or other specified period. Such conversion was based on the simple proportion: Corrected weight is to the sum of the weight of rats at specified period, as 100 grams is to the sum of the weight of the same rats at 21 days; or,

$$\text{corrected weight} = \frac{\text{sum of weight of rats at specified period} \times 100}{\text{sum of weight of same rats at 21 days}}.$$

Table I

	Controls	Group A		Group B		Group C		Group D		Group E	Total
		High Division	Low Division	High Division	Low Division	High Division	Low Division	High Division	Low Division		
Weight at 21 days											
Under 30 gm.	7	3	5	—	4	3	3	6	1	10	42
30–34 gm.	15	7	3	11	6	4	6	4	8	7	71
35–39 gm.	—	—	2	1	1	—	1	2	3	—	10
40–44 gm.	1	—	1		1	1	2			2	8
45–49 gm.		1	—			2				1	4
50–54 gm.		1	—			1					2
55–59 gm.	1		1			1					3
	—	—	—	—	—	—	—	—	—	—	—
	24	12	12	12	12	12	12	12	12	20	140
Average weight of divisions (gm.)	32.63	34.07	34.27	33.42	32.28	37.90	33.20	30.59	33.03	31.20	33.09
Average weight of groups (gm.)		34.17		32.85		35.55		31.81			

Distribution by individual weight of the 140 twenty-one day old rats in the several groups and divisions. The animals varied from 26.5 gm. to 56.6 gm. on receipt at twenty-one days of age. The table illustrates the number of rats of different specified weights in each of the ten established divisions. The animals were assigned to these divisions by chance selection. The animals in the "low" divisions received solutions of P^{32} which contained 100 times the amount of inert phosphate present in the P^{32} stock solution administered to the high division rats.

Table II

	Controls	Group A		Group B		Group C		Group D		Group E	Total
		High Division	Low Division	High Division	Low Division	High Division	Low Division	High Division	Low Division		
Femoral length in mm.											
15	6	4	7		1	1		1		1	21
16	16	5	4	11	11	6	8	8	8	15	92
17	1	3	1	1		2	4	3	4	4	23
18	1					2					3
19						1					1
	—	—	—	—	—	—	—	—	—	—	—
	24	12	12	12	12	12	12	12	12	20	140
Average length of divisions (mm.)	16.06	16.12	15.73	16.42	18.17	16.75	16.46	16.30	16.42	16.35	16.26
Average length of entire group (mm.)		15.94		16.29		16.60		16.36			

Distribution of the 140 twenty-one day old albino rats by length of the individual rat femurs in the several groups and divisions. The length of the femurs varied from 15 mm. to 19 mm. on receipt at twenty-one days of age. The table illustrates the number of rats with different specified femoral lengths in each of the ten established divisions. The animals were assigned to these divisions by a purely chance selection. Rate in the "low" divisions received solutions of P^{32} which contained 100 times the amount of inert phosphate present in the P^{32} stock solution administered to the high division rats.

TABLE III

Age in days	21	28	56	84	112
Weight at 21 days					
Under 30 grams					
(7 rats)	100	123	296	364	457
30 grams and over					
(15 rats)	100	124	276	338	412

Comparative gain in weight of control rats whose weight at twenty-one days was (a) under 30 grams and (b) 30 grams and over. The combined weights of each subgroup at twenty-one days of age are expressed as 100 grams. The values listed represent the relative weight of each subgroup at the age indicated.

INTERVAL WEIGHT GAIN

	21–28 days	28–56 days	56–84 days	84–112 days
Rats weighing:				
Under 30 grams	23	140	23	26
30 grams and over	24	123	23	22

Comparative interval weight gain in the two subgroups. Each value represents the percentage weight gain during the period of days indicated.

TABLE IV

Age in days	21	28	56	84	112
Rat femurs measuring:					
15 mm.	100	116	161	177	187
16 mm. and over	100	112	153	168	174

Comparative growth of femurs of control rats whose femurs measured 15 mm. at twenty-one days with those control animals whose femurs originally measured 16 mm. and more in length. The combined lengths of the femurs of each subgroup are expressed as 100 mm. The values listed represent the relative increase in the lengths of the femurs of each subgroup at the age indicated over the initial length at twenty-one days.

INTERVAL GROWTH

	21–28 days	28–56 days	56–84 days	84–112 days
Rat femurs measuring:				
15 mm.	16	39	10	6
16 mm. and over	12	37	10	4

Comparative interval growth of femurs in the two subgroups. Each value represents the percentage increase in length during the period of days indicated at the head of the columns.

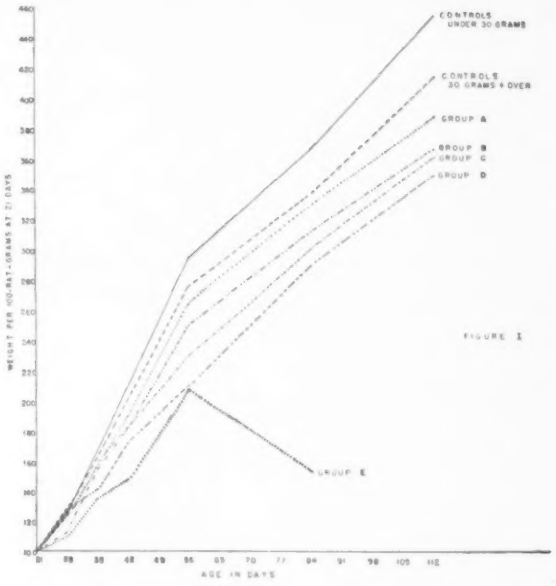

FIG. 1. Comparative effect of increasing doses of P^{32} on the gain in weight of twenty-one day old albino rats. The growth of control rats is also indicated (see Table v).

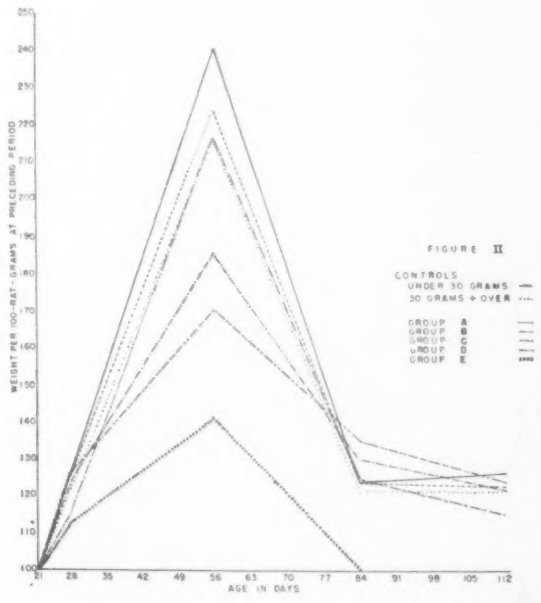

FIG. 2. Comparative effect of increasing doses of P^{32} on the interval weight gain of twenty-one day old albino rats (see Table vi).

Study of Table III and Figure 1, which use these adjusted weights, demonstrates that the animals which weighed less than 30 grams at twenty-one days gained more weight per 100 rat grams after any specified number of days than rats weighing 30 grams or more at twenty-one days. Comparable findings are noted when femoral

TABLE V

Age in days		21	28	35	42	56	84	112
Dosage of P^{32} by groups								
Controls	Total	100	124			287	358	442
Under 30 grams	(received no P^{32})	100	123			296	364	457
30 grams and over		100	124			276	338	412
Group A	Total	100	122	153	187	263	326	384
44 μc/kg.	High division	100	125	153		268	336	389
	Low division	100	120	154	198	257	316	376
Group B								
132 μc/kg.	Total	100	115	156	182	248	315	367
	High division	100	113	152	178	243	303	344
	Low division	100	119	161	182	255	330	405
Group C	Total	100	123	159	183	228	301	362
400 μc/kg.	High division	100	121	151	171	218	287	352
	Low division	100	126	167	194	237	315	372
Group D	Total	100	125	141	173	210	291	347
1,200 μc/kg.	High division	100	125	146	175	225	304	382
	Low division	100	124	135	171	196	274	303
Group E		100	112	136	148	206	155	—
3,600 μc/kg.								

Comparative effect of increasing doses of P^{32} on the gain in weight of twenty-one day old albino rats. The combined weights of all the animals of each group or division at twenty-one days of age is expressed as 100 grams. The values listed represent the relative weight of each group or division at the age indicated. The low division animals received solutions of P^{32} which contained 100 times the amount of inert phosphate present in the P^{32} stock solution administered to the high division rats.

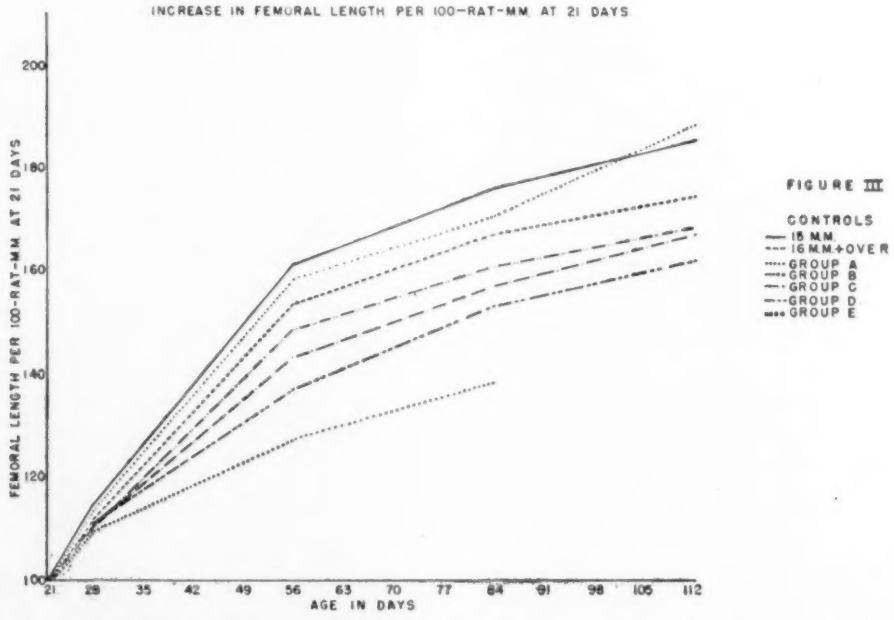

FIG. 3. Comparative effect of increasing doses of P^{32} on the growth of the femurs of twenty-one day old albino rats. The normal growth of the control rats is also shown (see Table VII).

lengths are treated in the same manner. The increase per 100 rat millimeters of femoral length at twenty-one days is greater after 112 days or any part thereof, and the rate of growth is greater, in animals whose femurs originally measured less than 16 mm. (see Table IV and Fig. 3).

The weights per 100 rat grams at twenty-one days of the control group are presented in Table V, along with all the groups receiving P^{32}. These corrected weights are arranged for comparison. "High" and "low" divisions of each group are expressed separately, and the sum of all the animals in the group is recorded as a total adjusted weight for the animals in the individual group.

The relative increase in weight of each division receiving P^{32} is less than the control group. In addition, the relative increase in the combined weight of the respective "high" and "low" divisions of the several groups falls, in a regular progression, below the curves for the controls, with the greatest retardation occurring in those animals receiving 3,600 μc. of radiophosphorus per kilogram, and the least retardation occurring in the animals receiving only 44 μc/kg. There appears to be no significant difference between the high and low concentrations of the isotope (Fig. 1).

TABLE VI

		21–28 days	28–56 days	56–84 days	84–112 days
Dosage of P^{32} by groups					
Controls (received no P^{32})		24	132	23	25
Animals weighing under 30 grams		23	140	23	26
Animals weighing over 30 grams		24	123	23	22
Group A	Total	22	115	21	21
44 μc/kg.	High division	25	115	20	23
	Low division	20	114	23	20
Group B	Total	15	116	26	15
132 μc/kg.	High division	13	115	25	16
	Low division	19	116	28	15
Group C	Total	23	85	30	22
400 μc/kg.	High division	21	81	31	23
	Low division	26	89	29	21
Group D	Total	25	70	34	23
1,200 μc/kg.	High division	25	82	33	28
	Low division	24	70	35	17
Group E 3,600 μc/kg.		12	41	−1	—

Comparative effects of increasing doses of P^{32} on the interval weight gain of twenty-one day old albino rats. Each value represents the percentage weight gain during the period of days indicated. The low division animals received solutions of P^{32} which contained 100 times the amount of inert phosphate present in the P^{32} stock solutions administered to the high division rats.

Percentage increase of weight was also calculated for each specified period. Table VI and Figure 2 show that the retardation occurs prior to the eighty-fourth day. In the last month of observation, no difference in the rate of weight increase in any of the animals still alive was observed. This indicates that P^{32} ceases to produce retardation of growth as soon as its radioactivity has fallen below a threshold value. The twenty-one day old rats received their last

dose of P^{32} on the forty-second day of life. (The progressive decrease in radioactivity of administered P^{32} is due to two factors: disintegration of the isotope which has a half-life of 14.3 days; continuous excretion of phosphorus.)

Analysis of the effects of radiophosphorus on the growth of femurs was made in the same manner. This revealed that comparable changes occurred in femoral lengths as in the weights of rats, with the exception of Group A. No difference between high and low concentrations was seen, and again, since the effect upon increase of femoral length disappeared by the eighty-fourth day, there is indication that the effects of P^{32} cease when the radioactivity has fallen to a low level (Table VIII, Fig. 4). Similarly the degree of retardation of the growth of the femurs increased with increase in the dose of radiophosphorus; except as indicated above in Group A, where growth appears somewhat accelerated (Tables VII and VIII, Fig. 3 and 4).

In the case of rats receiving 1,200 μc/kg. (Group D) and 3,600 μc/kg. (Group E), the above noted retardation of growth was apparent without resorting to measurement. The activity of these animals was diminished. The Group D rats, though their activity was diminished, performed any movement they undertook with agility. The animals which received the highest dosage became, after about six weeks of age, not only less active, but increasingly faltering in their movements. At about fifty-six days of age, they were little interested in food, and many of them would sit

TABLE VII

Age in days		21	28	56	84	112
Dosage of P^{32} by groups						
Controls (received no P^{32})	Total	100	113	155	170	179
Femurs 15 mm. long		100	116	161	177	187
Femurs 16 mm. long and over		100	112	153	168	174
Group A						
44 μc/kg.	Total	100	115	159	171	189
	High division	100	113	157	169	178
	Low division	100	117	161	172	202
Group B	Total	100	113	149	161	169
132 μc/kg.	High division	100	112	148	160	167
	Low division	100	114	150	163	173
Group C	Total	100	114	145	158	168
400 μc/kg.	High division	100	114	145	157	169
	Low division	100	114	145	159	168
Group D	Total	100	113	138	154	162
1,200 μc/kg.	High division	100	113	138	157	166
	Low division	100	113	137	151	155
Group E 3,600 μc/kg.		100	111	128	139	—

Comparative effect of increasing doses of P^{32} on the growth of the femurs of twenty-one day old albino rats. The combined lengths of the femurs of all the animals of each group and division at twenty-one days of age are expressed as 100 mm. The values listed represent the relative length of the femurs of each group or division at the age indicated. The low division animals received solutions of P^{32} which contained 100 times the amount of inert phosphate present in the P^{32} stock solutions administered to the high division rats.

Table VIII

		21–28 days	28–56 days	56–84 days	84–112 days
Dosage of P^{32} by groups					
Controls (received no P^{32})	Total	13	37	10	5
Femurs 15 mm. long		16	39	10	6
Femurs 16 mm. long and over		12	37	10	4
Group A	Total	15	38	8	12
44 μc/kg.	High division	13	39	8	6
	Low division	17	38	8	18
Group B	Total	13	32	9	5
132 μc/kg.	High division	12	32	8	5
	Low division	14	31	9	5
Group C	Total	14	28	9	7
400 μc/kg.	High division	14	28	5	8
	Low division	14	28	10	6
Group D	Total	13	22	12	5
1,200 μc/kg.	High division	13	23	13	6
	Low division	13	22	10	4
Group E 3,600 μc/kg.		11	15	6	

Comparative effects of increasing doses of P^{32} on the interval growth of the femurs of twenty-one day old albino rats. Each value represents the percentage increase in length during the period of days indicated. The low division animals received solutions of P^{32} which contained 100 times the amount of inert phosphate present in the P^{32} stock solutions administered to the high division rats.

in one position for hours as though narcoleptic. On several occasions, because of this stupor, it was difficult to know if an individual animal had died.

The coat of the rat suffered when the animals received 1,200 μc/kg. or more. Normally brilliant white and possessed of dense fine hairs, the coats of the animals in Groups D and E became sparse and coarse. This was noticeable in Group D and was quite marked in Group E (Fig. 6, 7 and 8).

All animals received at twenty-one days of age which were given 3,600 μc/kg. of P^{32} subsequently died. The average life of these animals was sixty-eight days. Only 3 of these rats lived over eighty-four days, the oldest living to eighty-nine days. Six

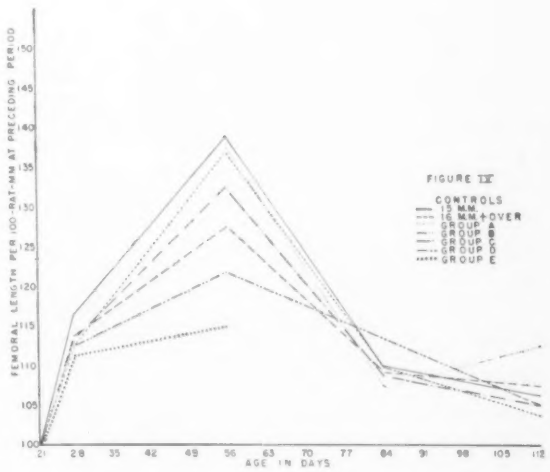

Fig. 4. Comparative effect of increasing doses of P^{32} on the interval growth of the femurs of twenty-one day old albino rats (see Table VIII).

rats died before fifty-six days of age. The earliest death occurred at fifty-three days. Inspection of Table IX will show that deaths from all causes increased with increase in the dose of the isotope. In Group E, a serosanguineous discharge from the nose and eyes appeared several days before death. Rats reported missing were assumed to be cannibalized, although on several occasions no telling rat bone could be found in the cages.

neither the data for weight nor those for femoral length showed the regularly increasing effect of increased dosage that was apparent in the twenty-one day old groups. However, certain observations revealed that some effect was present.

The coats of the rats which received 1,200 μc/kg. and 3,600 μc/kg. were not as fully developed nor as glistening. Also, the forty-two day old rats receiving the highest dose were not as active in their

TABLE IX

STATUS OF RATS AT 112TH DAY OF LIFE

	Survived	Autopsied	Classification of Deaths					Total dead (except autopsies)
			Missing	Killed	Nembutal	"Infection"	Cause not stated	
Rats Received at 21 Days								
Controls (24 rats)	20	4						0
Group A (24 rats)	21	2			1			1
Group B (24 rats)	17	5	1	1				2
Group C (24 rats)	18	2	1		2	1		4
Group D (24 rats)	13	2	2	1	3	3		9
Group E (20 rats)	0	1			1	18		19
Rats Received at 42 Days								
Group A (24 rats)	15	3	2		1	1		4
Group B (24 rats)	19	1	1			1	1	3
Group C (24 rats)	14	2			1			1
Group D (24 rats)	11	1						0
Group E (20 rats)	9	3				8		8

In 21 day old rats, the number dead of various causes increased with the size of dosage.
Eight of the 42 day old rats died who received 3,600 μc/kg. of P^{32}.
"Infection" is title applied to rats which developed serosanguineous discharge from nose and eyes before death.

SIX WEEK OLD RATS

Originally, it was planned to record the weight and measure the femurs of rats received at forty-two days of age (adolescent) in the same manner as the three week old rats. However, unavoidable circumstances prevented us from following a similarly rigid schedule in examining the specimens, so that the data are less satisfactory.

Although the rats were not weighed and measured as regularly as in the previously reviewed animals, an attempt was made to analyze them in the same way. Statistically

cages as the controls. Finally, in Group E, nearly half the animals not sacrificed for autopsy were dead by the 112th day. Many of these exhibited a serosanguineous discharge from the anterior nose and eyes as did the highest dosage animals in the twenty-one day old groups.

RATS SURVIVING 300 DAYS

At approximately 300 days, 94 rats of all groups were measured. No residual effect of P^{32} is seen in any of these. Those of the forty-two day old rats which received 3,600 μc/kg. of radiophosphorus and did

TABLE X

		Under 225 gm.	225–274 gm.	275–324 gm.	325 gm. and over
Total rats	(94)	10	45	30	9
Controls	(12)	1	7	3	1
Treated rats	(82)	9	38	27	8
21 day old	(38)	1	19	13	5
42 day old	(44)	8	19	14	3
Groups A and B	(37)	3	20	12	2
21 day old	(23)	—	12	9	2
42 day old	(14)	3	8	3	—
Groups C, D and E	(45)	6	18	15	6
21 day old	(15)	1	7	4	3
42 day old	(30)	5	11	11	3

Percentage Distribution by Weight

	Under 225 gm.	225–274 gm.	275–324 gm.	325 gm. and over
Total	11	48	32	9
Controls	8	59	25	8
Total treated	11	46	33	10
Groups A and B	7	54	32	6
Groups C, D and E	13	40	34	13

Recovery from the effects of P^{32} as evidenced by distribution of 300 day old survivors in various weight categories.

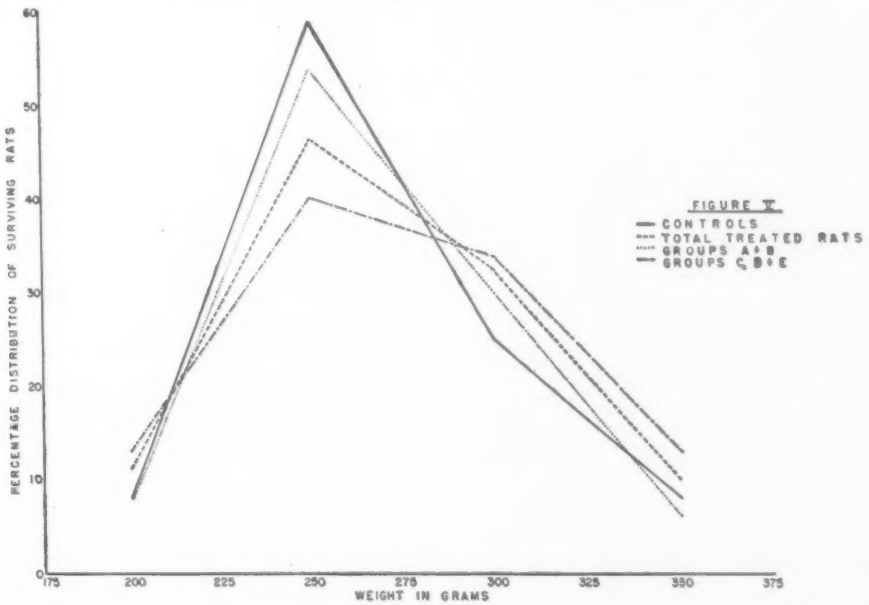

FIG. 5. The percentage distribution by weight of rats in the several groups who survived approximately 300 days. This includes rats received at both twenty-one days and forty-two days of age. The effect of P^{32} on growth appears to be temporary, as the rats outgrew the effects if it did not kill them.

not die had outgrown any effects of the drug and were equal in size, weight and appearance to the controls and other animals (Table x, Fig. 5). There is little correlation between the initial weight of the rats at twenty-one days and the survivors at 300 days. Thus, in sublethal doses radiophosphorus has only a temporary effect on growing rats.

Chart I

BLOOD STUDIES ON 9 RATS—GROUP E SURVIVING 65 DAYS

	No. 137	No. 125	No. 144	No. 124	No. 138	No. 142	No. 139	No. 141	No. 122
Hemoglobin	10 gm.	11.5 gm.	9.5 gm.	11.5 gm.	10 gm.	9 gm.	10.5 gm.	9.5 gm.	12.5 gm.
Red blood cells (in millions)	6.31	7.43	4.63	7.77	5.29	4.56	6.03	4.95	6.77
White blood cells	6,600	3,300	1,800	2,800	3,300	2,400	2,700	3,600	4,000
Polymorphonuclears	56	28	42	14	41	58	26	32	30
Non-filaments	18	16	4	6	16	20	10	6	10
Filaments	38	12	38	8	25	38	16	26	20
Lymphocytes	34	62	52	82	54	38	61	60	62
Monocytes	4	0	2	0	2	2	6	4	4
Eosinophils	0	2	0	0	0	0	0	2	0
Basophils	0	0	0	0	0	0	0	0	0
	Premyelocytes 2 Immature Lymphs 4	Blasts 6 Premyelocytes 2	Türk 2 Premyelocytes 2	Immature Lymphs 2 Blasts 2	Immature Lymphs 2 Türk 1	Premyelocyte 2	Immature Monocyte 3 Premyelocyte 2 Türk 2	Türk 2	Immature Lymphs 2 Türk 2
Platelet count	182,990	230,330	212,989	248,640	42,320	218,880	192,960	133,380	336,380

BLOOD PICTURE OF GROUP E THREE WEEK OLD RATS SURVIVING SIXTY-FIVE DAYS

Nine rats which received 3,600 μc/kg. were alive at sixty-five days. Complete blood counts were performed on these animals and compared with the counts in Wistar Institute rats of approximately the same age.* All of the 9 animals had a hemoglobin below the 13.2 gm. normal level and 8 of these had counts between 9 and 11.5 gm. The red blood cell counts on all of these retarded animals fell below the 8.02 million mean, and 6 of the 9 were below the 6.30 million lower limit of the range. Four animals had counts between 4.56 and 5.29 million red blood cells.

The leukocyte count of all the rats in this group was below the lower limit of normal and in all cases markedly so. These counts ranged from 1,800 to 6,600 cells/mm.^{3}, all but one being 4,000 or less. The low normal observed by Farris is 9,250. In all but one case the differential count demonstrated less depression in the number of polymorphonuclear cells than of the other white cells. The normal differential polymorphonuclear count is 26.6 per cent.* Four animals demonstrated polymorphonuclear leukocytes in percentages of 26, 28, 30 and 32. Four animals ranged from 41 to 58 per cent. One animal, the exception mentioned above, had a percentage of polymorphonuclear cells amounting to 14.

Several abnormal cells were found in each animal including premyelocytes, immature lymphocytes, blast forms and Türk cells (see Chart I for distribution).

Thus, considerable effect was noted on the cellular elements of the blood of the twenty-one day old rats who received a lethal dose of radiophosphorus. The effect on the white blood cells was profound, with a tendency toward greater effect on the mononuclear series.

HISTOPATHOLOGY

Histopathologic Technique. After death the femurs were disarticulated and placed in ten per cent formalin for fixation. The

* Unpublished work, Dr. Edmond Jr. Farris, Wistar Institute.

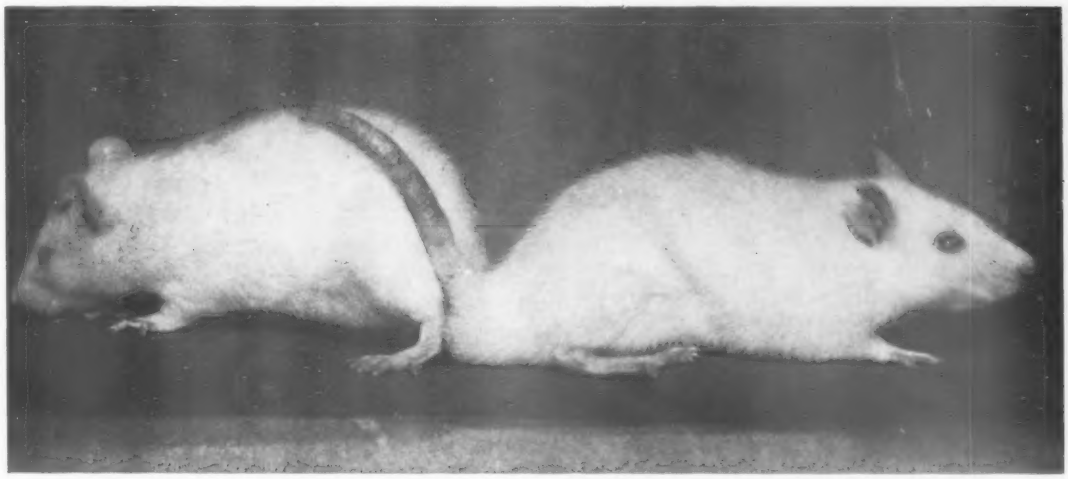

Fig. 6. Three week old rats of the control group at sixty-five days of age. Compare size and appearance of coat with animals in Group D and Group E in Figures 7 and 8.

Fig. 7. Three week old rats, at sixty-five days of age. *Right*, Group D; *center*, control: *Left*, Group E. The animals from the groups receiving 1,200 and 3,600 μc/kg. of P^{32} per month are smaller, and their coats are less sleek.

Fig. 8. Three week old rats, at sixty-five days of age, Group E. These animals are obviously retarded in development and scrawny when compared with the healthy control animals in Figure 6. They were prone to remain in one position for hours.

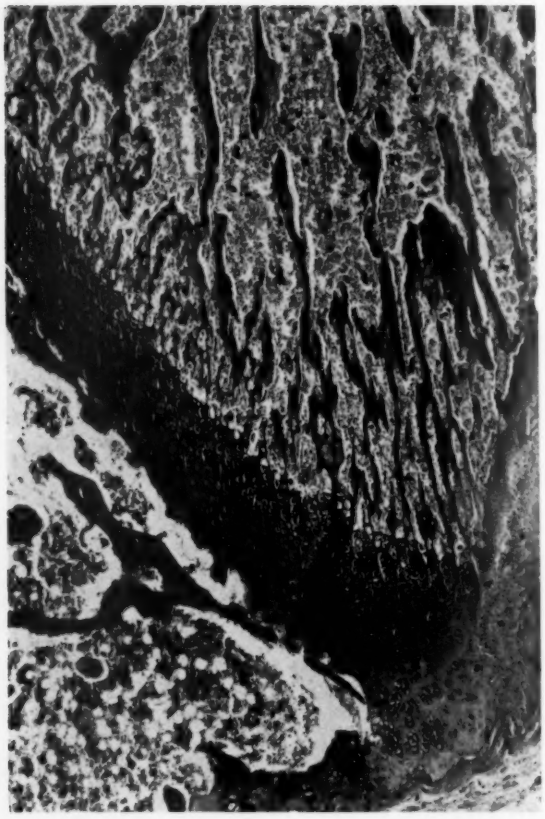

Fig. 9. Photomicrograph (×40). Three week old rat at fifty-six days of age. Control group. This represents a normal zone of enchondral ossification. Note regular arrangement of columns of cartilage cells, and an orderly transition of these cells from normal cartilage, through the stage of vacuolization, to normal bone formation.

bones were decalcified according to standard procedure and stained with hematoxylin and eosin.

Comparison of the several groups with the controls and with themselves at any specified age showed no variation from normal, with the exception of 4 rats which attained the age of fifty-six days and had received 3,600 μc/kg. of P^{32}. The histopathological appraisal of those 4 rats demonstrated abnormal alterations involving the marrow and epiphyseal portions.

In the marrow the changes were of a degenerative nature. In this connection it is pertinent to point out certain facts. First, an unknown interval existed between the death of each of the 4 rats and their discovery. Second, the changes were not unlike those seen in cases of postmortem autolysis and in improperly fixed tissues. Third, depression of hematopoiesis was reflected in the peripheral blood studies (*ibid.*). However, a similar marrow picture was observed in a rat twenty-eight days old which had received 132 μc/kg. of P^{32}, and which showed no other histopathologic abnormality.

Presenting a more significant picture are the changes wrought in the zone of enchondral ossification.[7] The deviations are much alike in all 4 rats (Fig. 9, 10, 11 and 12). Most conspicuous is a qualitative and quantitative alteration with widening of this zone as a result of increase in the number and size of cartilage cells. Almost all are greatly vacuolated and contain irregular masses of blue-staining material. The usual columnar symmetry is distorted. The intervening matrix is often fibrillar or

Fig. 10. Photomicrograph (×160). Three week old rat, at fifty-six days of age. Control group. Same animal and area as Figure 9, but with higher magnification.

granular and stains intensely blue. The bases of the cartilaginous columns are scalloped and do not demonstrate equal degrees of erosion. Extending into the metaphyses are some columns of unresorbed cartilage cells. The spicules have a more irregular pattern than usual and osteoid material is not as prominent. Osteoblasts are scant, if at all present. Vessels are difficult to make out, but no thickened structures are seen.

ROENTGEN STUDY

The roentgenograms of the twenty-one day old rats which were used to determine femoral lengths were examined for alterations in bone detail. In the studies made at twenty-eight days of age, no difference in bone structure is visible in any of the groups. The shape, cortical contour and the epiphyseal areas are similar in all groups receiving P^{32}, nor can they be differentiated from the controls.

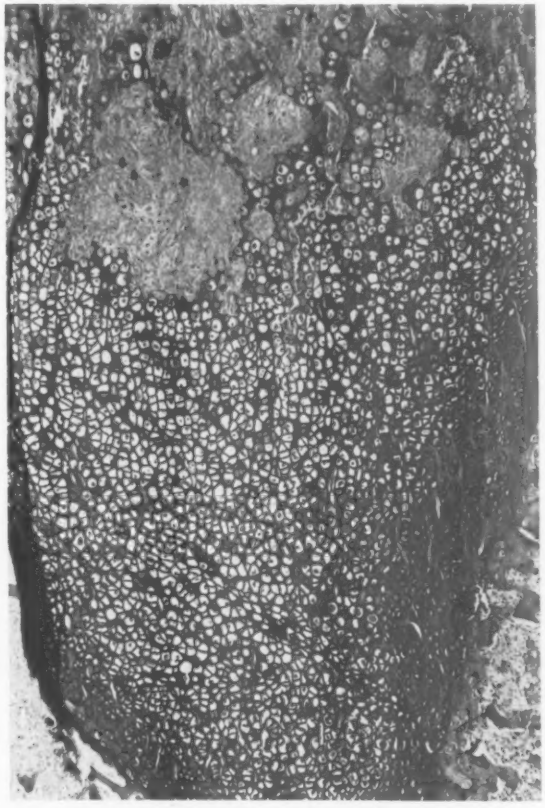

Fig. 11. Photomicrograph (×40). Three week old rat, at fifty-six days of age. Group E. Note widening of the zone of enchondral ossification with increase in number and size of cartilage cells. There is no symmetrical arrangement of these cells in columns.

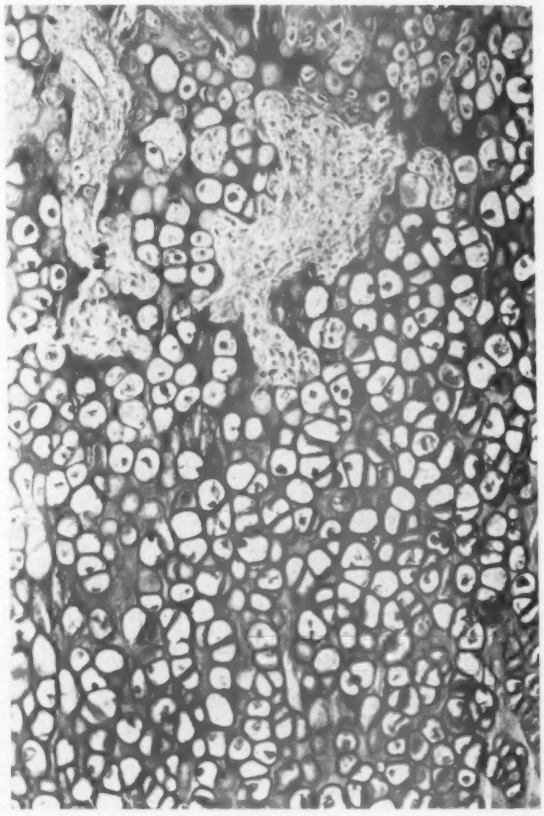

Fig. 12. Photomicrograph (×160). Three week old rat, at fifty-six days of age. Group E. Same animal and area as Figure 11, but with higher magnification.

Definite changes in the epiphyseal areas occurred at fifty-six days in rats receiving 3,600 μc/kg. of P^{32}. There was increase in the area of dense calcification adjacent to the epiphyseal line on the metaphyseal side. Not only was this area increased in thickness, but it was denser than the controls. This region corresponds to the histopathologic findings of increased thickness of the zone of enchondral ossification in the metaphysis of the long bones. Figures 13 and 14 illustrate a control and a rat of Group E, both of which were fifty-six days old. The increased area of calcification is best seen in the proximal tibial metaphysis,

Fig. 13. Three week old rat, at fifty-six days of age. Control group. Note the normal epiphyseal line in tibia and compare with Figure 14.

although similar changes are noted in the distal femoral metaphysis.

The cortices of the bones of Group E were thinner at fifty-six days than those of the controls. However, this might be due to the fact that the Group E rats weighed considerably less than the controls.

During the period of observation all of the groups including the controls showed no abnormality in the distal femoral epiphyseal ossification center.

Group D rats (1,200 μc/kg. of P^{32}) examined at fifty-six days showed slight increase in the area of dense calcification in the metaphysis. This was similar to that seen in Group E, but was only a minimal change when compared with the controls. This finding, though slight, was definite, and is noteworthy because of the lack of variation from normal, found in the histopathologic sections.

At 84, 112 and approximately 300 days of age, the roentgen appearance of the bones of animals in all the treated groups, except Group E, exhibited no variation from the controls. The slight changes noted in Group D at fifty-six days had disappeared by the eighty-fourth day.

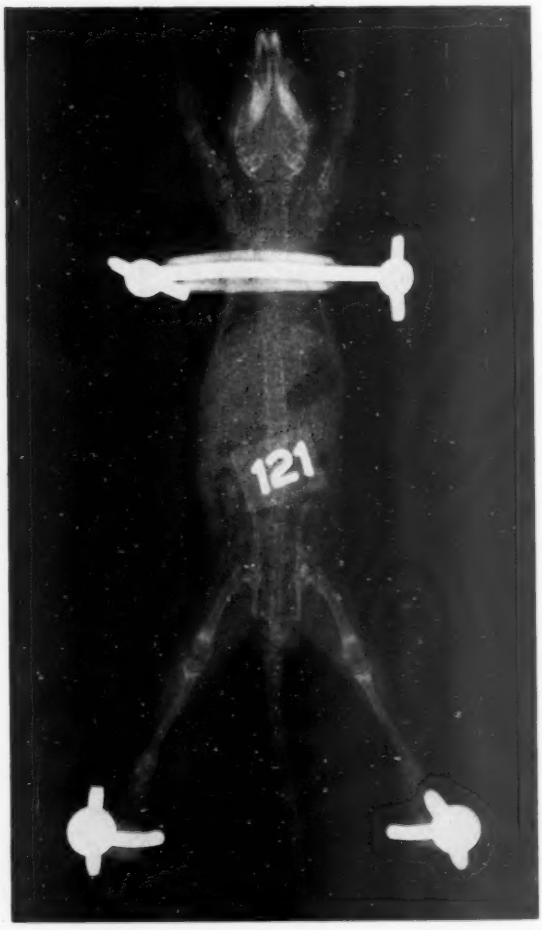

Fig. 14. Three week old rat, at fifty-six days of age. Group E. Note widening of the densely calcified zone adjacent to the epiphyseal line on the metaphyseal side. This corresponds to the widened zone of enchondral ossification seen in the microscopic studies (see Fig. 11 and 12).

SUMMARY AND CONCLUSIONS

1. Radioactive phosphorus retards normal weight gain in twenty-one day old albino rats. Doses of P^{32} as small as 44 μc/kg. caused this retardation. Larger doses caused progressively greater retardation in weight gain.

2. Radiophosphorus retards the growth of bone (femur) in twenty-one day old rats when administered in quantities of 132 μg/kg. Larger doses caused a progressively greater degree of retardation. Apparent acceleration in bone growth occurred when 44 μc/kg. were given.

3. The effect of P^{32} of high specific activity was no greater in causing the above changes than P^{32} administered in solutions containing 100 times the amount of inert phosphate that the concentrated stock solutions contained. The stock solutions were of high specific activity.

4. The effect of P^{32} on the growth of the albino rat (weight and long bones) ceases as soon as its concentration in the body falls below a threshold value. This level is reached within forty-two days after the last dose is given. Furthermore, the effect of radioactive phosphorus is temporary. Rats of all groups and initial ages which reached an age of approximately 300 days were equal in size, weight and appearance to the controls.

5. Doses of P^{32} amounting to 1,200 and 3,600 μc/kg. affected the physical appearance and activity of the rats in both age groups (21 day old and 42 day old). Half of the forty-two day old rats receiving 3,600 μc/kg. were dead by 112 days of age. Definite statistical evidence, however, is lacking in regard to the effect of P^{32} on the growth of this older age group.

6. Rats received at twenty-one days of age which were given a lethal dose of P^{32} (3,600 μc/kg.) revealed a depression of all the cellular blood elements with profound changes in the white blood count and a tendency toward greater effect in the mononuclear series. Histopathologically, the long bones of these rats showed increase in number and irregularity in the arrangement and size of cartilage cells in the zone of enchondral ossification.

7. Roentgenograms of twenty-one day old rats receiving 3,600 μc/kg. of P^{32} showed an increase in the densely calcified area on the metaphyseal side of the epiphyseal line. This region corresponds histologically to the zone of enchondral ossification. Similar but very slight changes were noted in those animals receiving 1,200 μc/kg. of P^{32}, although the histopathologic sections in these latter animals were normal.

The author is deeply indebted to Dr. W. Edward Chamberlain, not only for making this work possible, but for valuable counsel in connection with the research and preparation of this paper.

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PROTECTIVE MATERIALS FOR FIELD DEFINITION IN RADIATION THERAPY

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INFORMATION on roentgen-ray absorbers for use as walls or barriers about a roentgen-ray source is readily available. This information is most often in the form of a statement of the voltage used, with some additional information covering maximum intensity, distance and other pertinent data. The information is, in general, intended for use in arranging adequate protection from radiation for working personnel.

The use of protective materials as beam limiters or diaphragms is not so well documented. For this application, it is desirable to have information based on the voltage and half-value layer of the roentgen-ray beam, making it possible to quickly evaluate the more common protective materials and to determine the necessary thickness required to limit the radiation reaching the patient outside the treatment field to an acceptable value.

The materials considered were lead, brass, steel, lead rubber, lead glass and plate glass.

The data for these materials are presented in the form of tables and transmission curves. In therapy, the intensity of the beam striking the patient and the dose to be given are known, so from the tables or graphs it is a simple matter to compute the intensity or dose of radiation that would reach the patient through any given thickness of material.

The data on which this report is based were taken on pulsating-type equipment. The particular high voltage source and tube was determined by the voltage used. Specific equipments used were:

(1) Full-wave diagnostic unit with diagnostic tube
(2) Two-valve, half-wave therapy unit with 140 kv. (peak) oil-immersed tube
(3) 250 kv. (peak) self-rectified therapy unit
(4) 400 kv. (peak) self-rectified therapy unit
(5) 1,000 kv. (peak) resonant-type therapy unit
(6) 2,000 kv. (peak) resonant-type therapy unit

A Victoreen r-meter with appropriate chambers was used. Care was taken to eliminate to a negligible level stray and scattered radiation reaching the chamber from surrounding objects.

The kilovoltage and half-value layers together with the filtration and equipment used were:

Kv. (peak)	*Half-Value Layer*	*Equipment*	*Added Filter*
60	0.50 mm. Al	1	None
85	0.75 mm. Al	1	None
100	1.00 mm. Al	1	None
120	1.50 mm. Al	2	None
140	1.70 mm. Al	2	None
140	0.15 mm. Cu	2	None
140	0.50 mm. Cu	3	0.25 mm. Cu
200	1.00 mm. Cu	3	0.50 mm. Cu
250	2.00 mm. Cu	3	1.50 mm. Cu
250	3.00 mm. Cu	3	3.00 mm. Cu
400	4.00 mm. Cu	4	3.00 mm. Cu
400	5.00 mm. Cu	4	5.00 mm. Cu
1,000	3.20 mm. Pb	5	None
2,000	6.00 mm. Pb	6	None

Lead. Lead, of course, is the material most commonly used to cone or define a roentgen-ray beam. Information on the required thickness is usually confined to a statement of the thickness required for a given kilovoltage. In this study, not only kilovoltage but the half-value layer for the beam studied has been indicated. The voltage range was from 60 kilovolts peak to 2 megavolts. Data were taken for half-value layers from 0.5 mm. of aluminum to 6 mm. of lead.

The data have been plotted for thickness vs. transmission in per cent down to 0.1 per cent.

If some material other than lead is to be considered and if the transmission and beam characteristics are known, it is a simple matter from these curves to determine

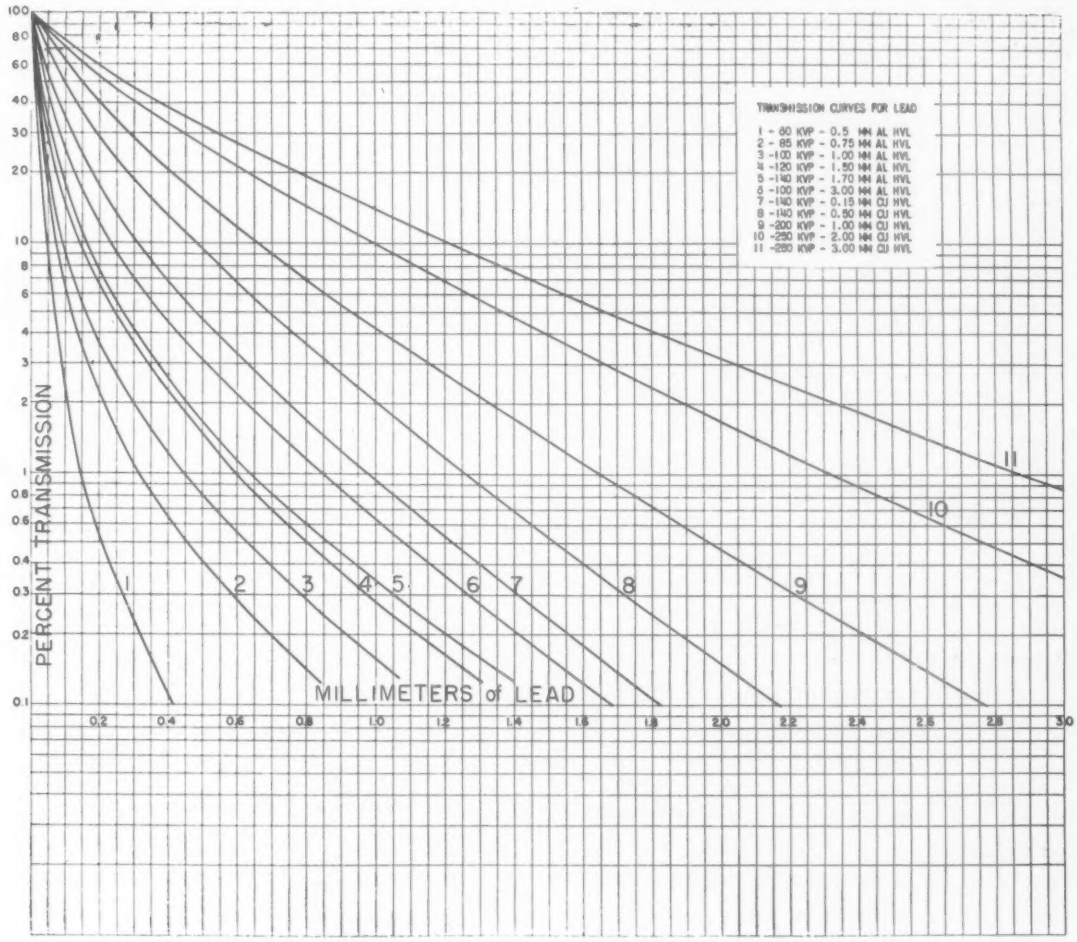
TRANSMISSION CURVES FOR LEAD
1 - 60 KVP - 0.5 MM AL HVL
2 - 85 KVP - 0.75 MM AL HVL
3 - 100 KVP - 1.00 MM AL HVL
4 - 120 KVP - 1.50 MM AL HVL
5 - 140 KVP - 1.70 MM AL HVL
6 - 100 KVP - 3.00 MM AL HVL
7 - 140 KVP - 0.15 MM CU HVL
8 - 140 KVP - 0.50 MM CU HVL
9 - 200 KVP - 1.00 MM CU HVL
10 - 250 KVP - 2.00 MM CU HVL
11 - 250 KVP - 3.00 MM CU HVL
PERCENT TRANSMISSION
MILLIMETERS of LEAD

Fig. 1. Transmission curves for lead. 60 to 250 kv. (peak).

the lead equivalent of the material in question. Actually, of course, the only thing that matters is the percentage transmission, for all that cones or beam definers are supposed to do is reduce the intensity of the part of the roentgen-ray beam that is not being used.

One of the most useful bits of information in this study is that having to do with lead in thin sheets. Thin lead, usually referred to as lead foil, is available in various thicknesses. It can be had with a very thin coating of tin which prevents oxidation and eliminates marking of clothing, etc. The thickness is sometimes specified in B and S gauge, sometimes in thousandths of an inch and sometimes in millimeters. The thicknesses most often encountered with the thickness stated in all three ways are:

B & S	*Inch*	*Millimeter*
36	0.005	0.127
26	0.016	0.407
19	0.036	0.915

In the thicker sections, the weight per pound is sometimes specified instead of stating the thickness. For ready reference, in Table I are listed some of the standard weights and corresponding thicknesses.

Quite often lead specifications call for a definite thickness in millimeters. Not always available from stock, it can usually be had on special order rolled to the desired metric specifications. For use in computing weights involved, in Table II is shown the nearest thickness in inches and the weight per square foot for the metric thicknesses most often encountered.

TABLE I

SHEET LEAD

Pounds per Square Foot	Thickness in Inches		Thickness in Millimeters
	Approximate	Actual	
2	1/32	0.034	0.86
3	1/20	0.051	1.29
4	1/16	0.067	1.70
6	1/10	0.101	2.55
7½	1/8	0.126	3.20
8	1/7	0.135	3.43
11	3/16	0.185	4.70
15	1/4	0.252	6.4
22½	3/8	0.378	9.6

TABLE II

SHEET LEAD

Thickness in Millimeters	Thickness in Inches (Approx.)	Weight (Pounds) per Square Foot
1	3/64	2.76
1½	1/16	3.68
2	5/64	4.59
2½	3/32	5.51
3	1/8	7.35
4	5/32	9.20
5	13/64	11.95
6	15/64	14.00
8	5/16	18.40
9	23/64	21.20
15	9/32	35.00
22	55/64	50.50
34	43/32	79.00

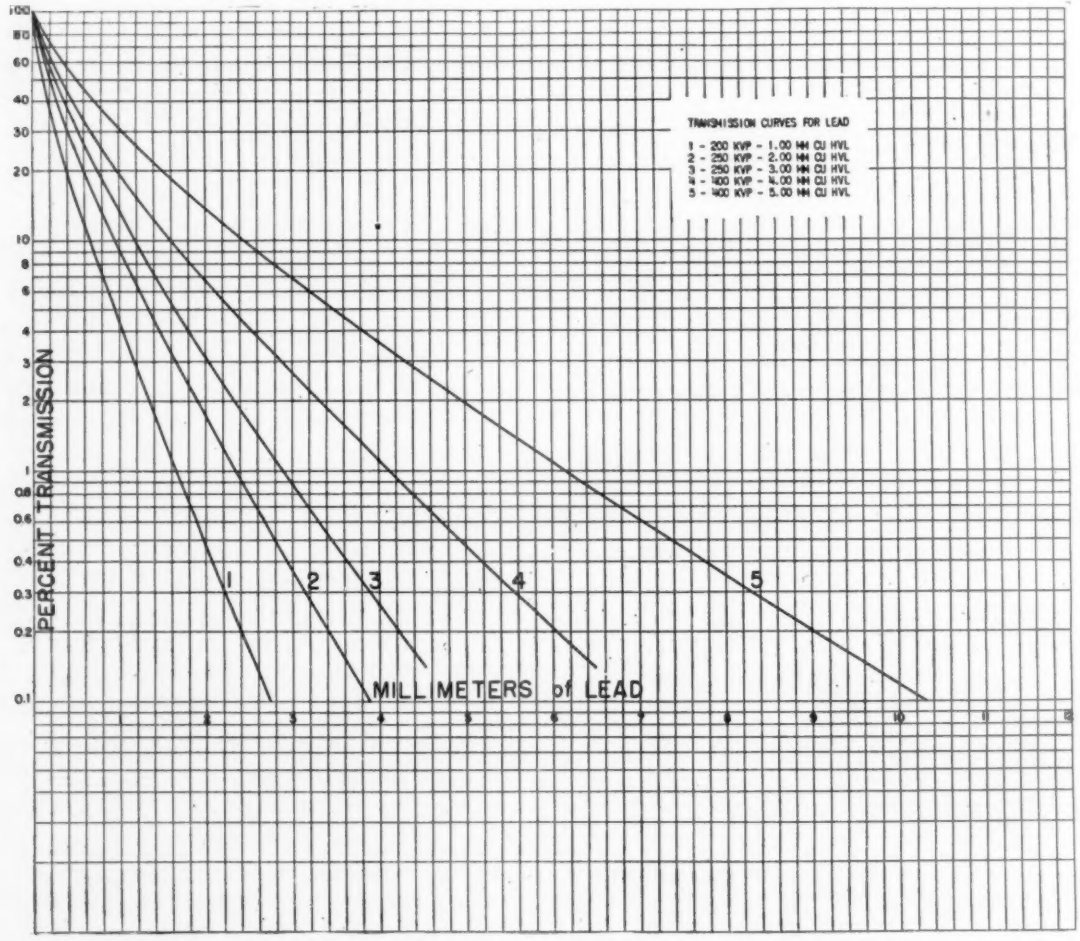
TRANSMISSION CURVES FOR LEAD
1 - 200 KVP - 1.00 MM CU HVL
2 - 250 KVP - 2.00 MM CU HVL
3 - 300 KVP - 3.00 MM CU HVL
4 - 400 KVP - 4.00 MM CU HVL
5 - 400 KVP - 5.00 MM CU HVL
PERCENT TRANSMISSION
MILLIMETERS of LEAD
1
2
3
4
5

FIG. 2. Transmission curves for lead. 200 to 400 kv. (peak).

TABLE III

TRANSMISSION TABLE FOR LEAD

Kv. (peak)	Half-Value Layer	Per Cent Transmission				
		10	5	1	0.5	0.1
		Millimeters				
60	0.50 mm. Al	0.05	0.07	0.15	0.21	0.42
85	0.75 mm. Al	0.07	0.12	0.32	0.46	0.71
100	1.00 mm. Al	0.09	0.16	0.45	0.68	1.17
120	1.50 mm. Al	0.14	0.25	0.60	0.80	1.40
140	1.70 mm. Al	0.16	0.27	0.64	0.86	1.50
140	0.15 mm. Cu	0.31	0.48	0.97	1.22	1.82
140	0.50 mm. Cu	0.48	0.70	1.26	1.52	2.17
200	1.00 mm. Cu	0.65	0.93	1.65	1.97	2.77
250	2.00 mm. Cu	1.00	1.37	2.31	2.77	3.90
250	3.00 mm. Cu	1.22	1.68	2.87	3.45	4.8
400	4.00 mm. Cu	1.60	2.30	4.10	4.90	6.9
400	5.00 mm. Cu	2.45	3.50	6.20	7.40	10.3
1,000	3.20 mm. Pb	14.0	20.5	38.0	46.0	65.0
2,000	6.00 mm. Pb	31.5	43.0	71.5	84.0	114.0

Brass. Data for brass are included in this report because of its frequent use in cones, specula and intracavity beam definers.

Brass is an alloy, and there are many alloy combinations all referred to as brass. A common alloy is yellow brass having a nominal composition of 65 per cent copper and 35 per cent zinc. Its absorption characteristics do not differ greatly from those of copper, for the atomic number is 29 for copper and 30 for zinc with densities of 8.9 and 7.1 respectively.

In considering the thickness necessary in the walls of specula and small cones, it is well to remember that the radiation does not strike the barrel at right angles. For this reason, the effective thickness of the barrel is always greater than the thickness of the cone or speculum wall.

Where brass can be used, it is especially desirable because it is easy to fabricate and machine, and is available in tubing of various diameters and wall thicknesses. Chrome plating provides a fine finish without any

TABLE IV

TRANSMISSION TABLE FOR BRASS

Kv. (peak)	Half-Value Layer	Per Cent Transmission				
		10	5	1	0.5	0.1
		Millimeters				
60	0.50 mm. Al	0.10	0.25	0.6	0.7	1.1
85	0.75 mm. Al	0.20	0.40	1.1	1.5	2.4
100	1.00 mm. Al	0.30	0.70	1.8	2.5	4.1
120	1.50 mm. Al	0.65	1.20	3.4	4.7	8.4
140	1.70 mm. Al	0.90	1.60	4.9	7.1	—
140	0.15 mm. Cu	1.50	2.60	6.8	9.1	—
140	0.50 mm. Cu	2.30	3.90	8.9	11.4	—
200	1.00 mm. Cu	6.00	8.90	16.8	20.3	—
250	2.00 mm. Cu	10.00	14.50	26.7	32.3	—
250	3.00 mm. Cu	13.00	18.40	32.0	38.1	—

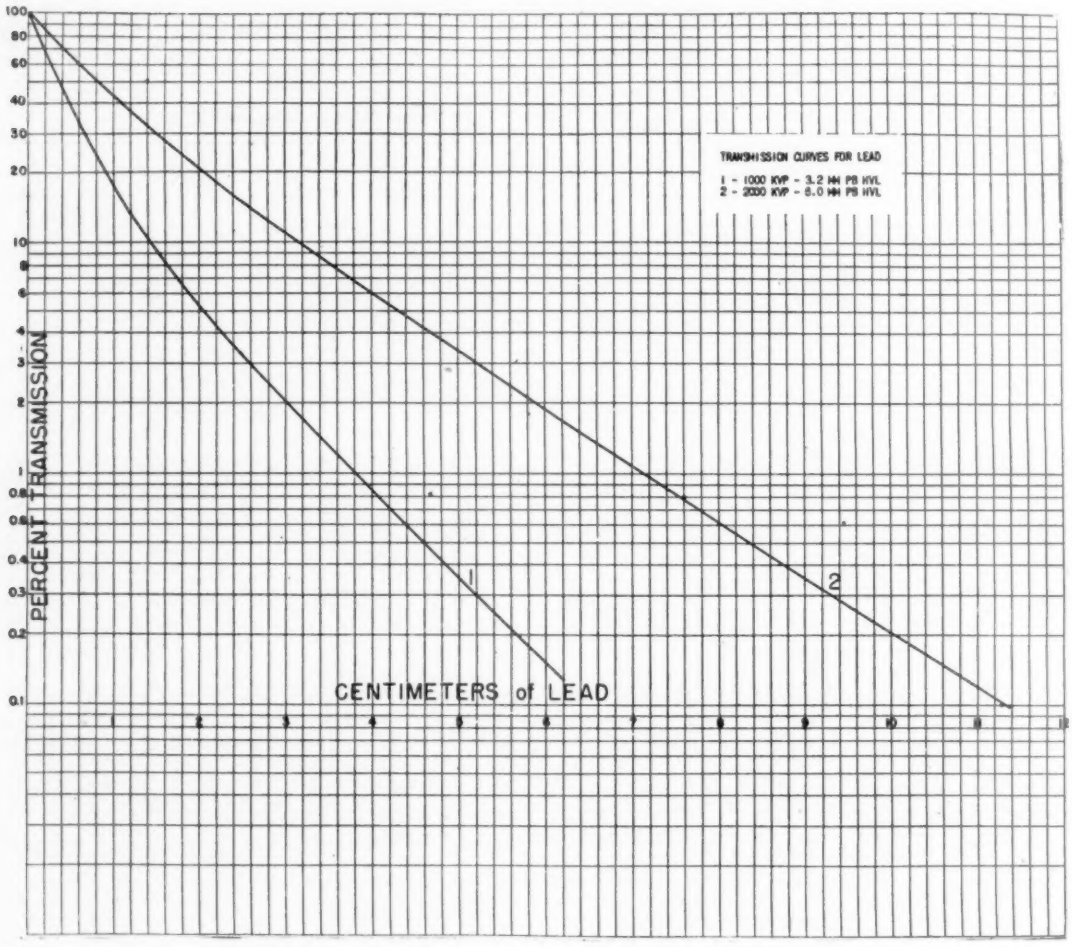

FIG. 3. Transmission curves for lead. 1,000 and 2,000 kv. (peak)

problem where sterilization is desirable.

The data for this paper were taken using the yellow brass alloy referred to above.

Steel. In the construction of cones, localizers, etc., steel alone or in combination with lead is often desirable because of its dimensional stability. In many systems of beam definition, adequate reduction in intensity can be had only through the use of lead. In these systems it is usually necessary to provide a steel protective sheath to support the lead. Where the thickness of

TABLE V

TRANSMISSION TABLE FOR STEEL

Kv. (peak)	Half-Value Layer	Per Cent Transmission				
		10	5	1	0.5	0.1
		Millimeters				
60	0.50 mm. Al	0.16	0.29	0.95	1.3	2.1
85	0.75 mm. Al	0.32	0.67	2.10	3.0	5.2
100	1.00 mm. Al	0.40	0.80	2.60	3.6	6.0
120	1.50 mm. Al	0.73	1.40	4.00	5.6	—
140	1.70 mm. Al	0.89	1.80	5.6	—	—

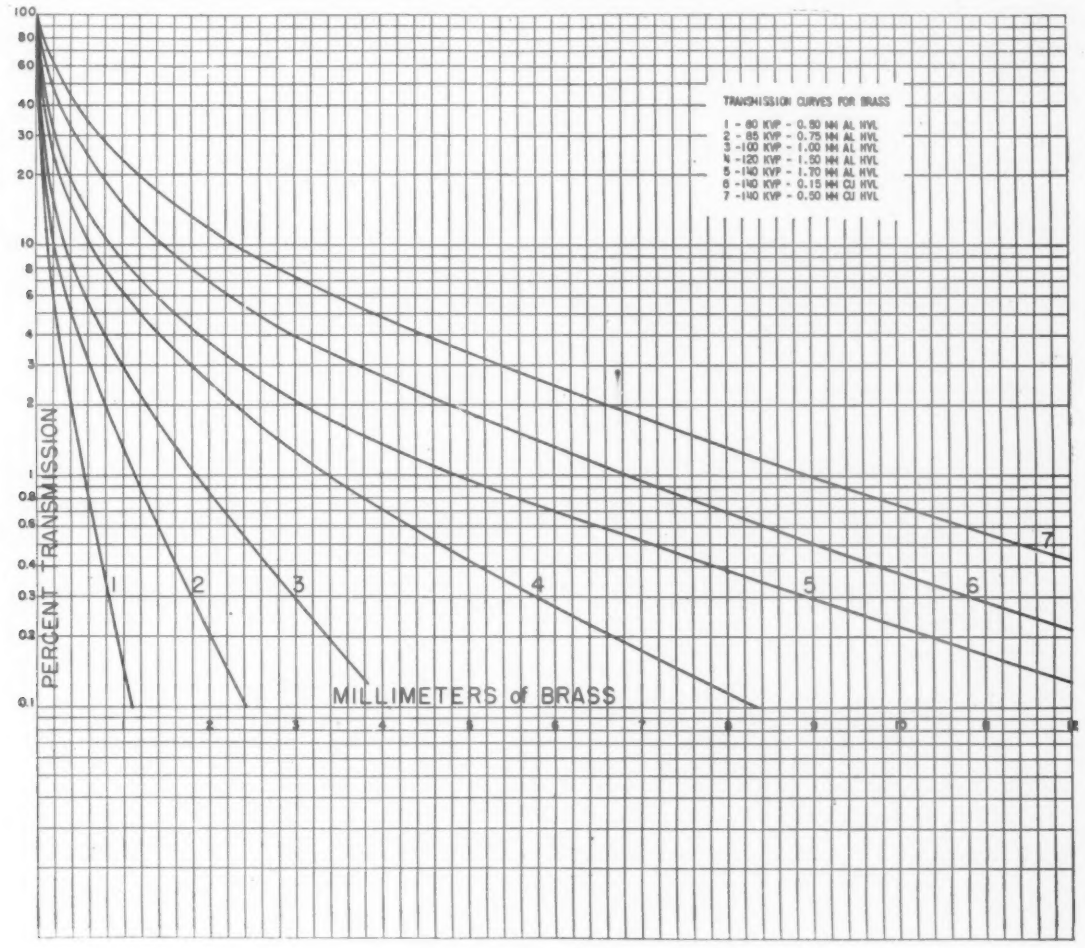
TRANSMISSION CURVES FOR BRASS
1 - 60 KVP - 0.80 MM AL HVL
2 - 85 KVP - 0.75 MM AL HVL
3 - 100 KVP - 1.00 MM AL HVL
4 - 120 KVP - 1.50 MM AL HVL
5 - 140 KVP - 1.70 MM AL HVL
6 - 140 KVP - 0.15 MM CU HVL
7 - 140 KVP - 0.50 MM CU HVL
PERCENT TRANSMISSION
MILLIMETERS of BRASS

Fig. 4. Transmission curves for brass. 60 to 140 kv. (peak).

the steel must be such as to permit machining, it may be used to provide part of the attenuation of the roentgen-ray beam. In low voltage systems, it may be used in sufficient thickness to provide adequate absorption without any lead being necessary.

The various types of steel or iron do not vary in their absorption properties enough to warrant differentiation.

The data on steel comprise one of the most useful pieces of information obtained for this report, for without this, steel has not received too much consideration in the design of beam limiting devices.

Lead Rubber. Lead rubber in various shapes is a very useful material for field definition for it can be placed directly on the patient to provide protection over areas that do not lend themselves to the usual cone shapes.

Good lead rubber is uniform in composition. The conscientious supplier roentgenographs or roentgenoscopes lead rubber protective material as a safeguard against reduced protection in any area.

For a given thickness the weight per unit area is a fair measure of the protective quality of such material. It is most often supplied in two thicknesses, 1/16 inch and 3/16 inch. The material reported here weighed 1.75 pounds per square foot for 1/16 inch and 5.17 pounds per square foot for 3/16 inch.

Because of the high absorption for the thinnest sections available, no attempt was made to plot transmission curves. The re-

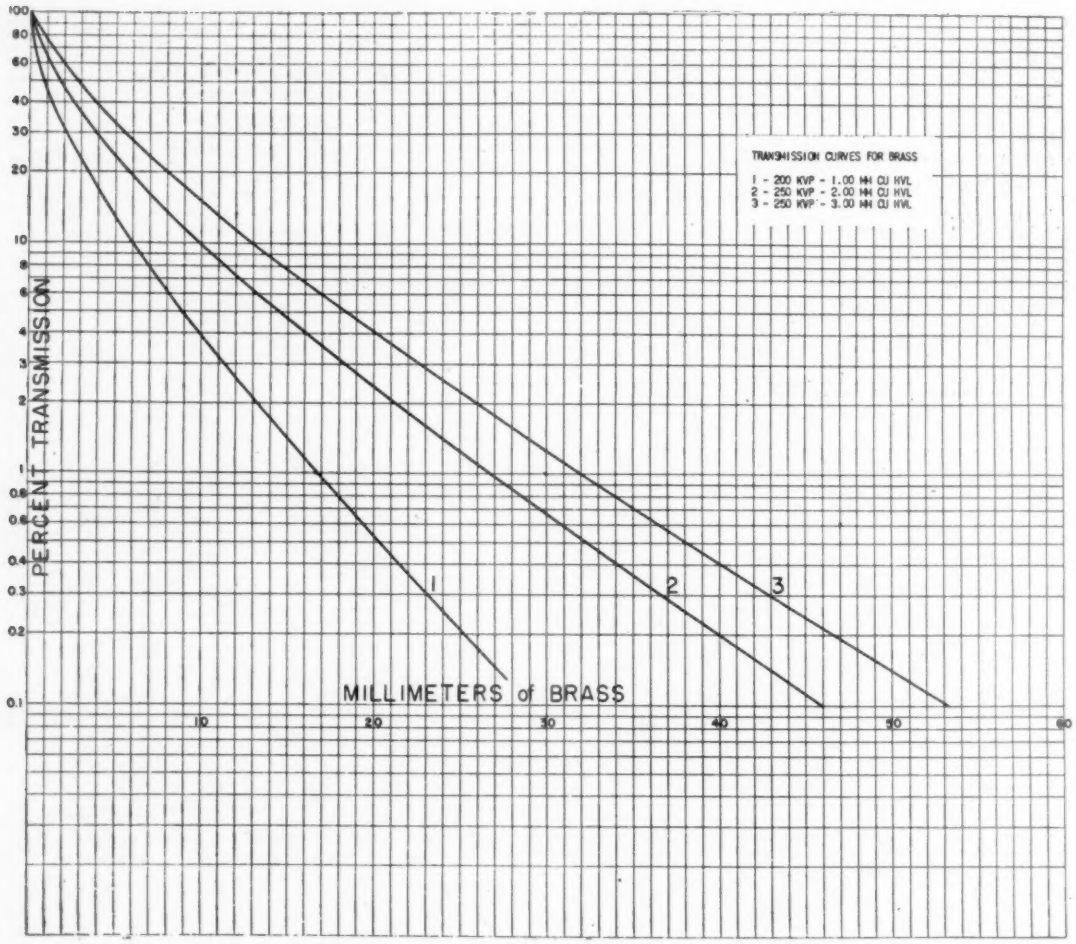
TRANSMISSION CURVES FOR BRASS
1 - 200 KVP - 1.00 MM CU HVL
2 - 250 KVP - 2.00 MM CU HVL
3 - 250 KVP - 3.00 MM CU HVL
PERCENT TRANSMISSION
MILLIMETERS of BRASS
1
2
3

FIG. 5. Transmission curves for brass. 200 to 250 kv. (peak).

sults were tabulated and appear in Table VI.

Lead Glass. Although most often used in viewing windows and over fluoroscopic screens, lead glass may find some use in defining roentgen-ray beams. Because it is part of the over-all problem of protective absorbers, it was made part of this study.

Lead glass is usually provided in sheets having a nominal equivalent of 1.5 mm. of lead at 100 kv. The thickness may vary somewhat from a nominal thickness of $\frac{1}{4}$ inch (6.3 mm.).

The material used in this study was purchased under specifications permitting a minimum thickness of 0.209 in. (5.3 mm.) and a maximum of 0.281 in. (7.1 mm.).

TABLE VI

TRANSMISSION TABLE FOR LEAD GLASS

Kv. (peak)	Half-Value Layer	Thickness	Per Cent Transmission
60	0.50 mm. Al	5.3 mm.	Less than 0.1
85	0.75 mm. Al	5.3 mm.	Less than 0.1
100	1.00 mm. Al	5.3 mm.	Less than 0.1
120	1.50 mm. Al	5.3 mm.	Less than 0.1
140	1.70 mm. Al	5.3 mm.	Less than 0.1

That of minimum thickness weighed 3.7 pounds per square foot, that of nominal thickness 4.6 pounds per square foot and that of maximum thickness 5.0 pounds per square foot.

The sections of minimum thickness were

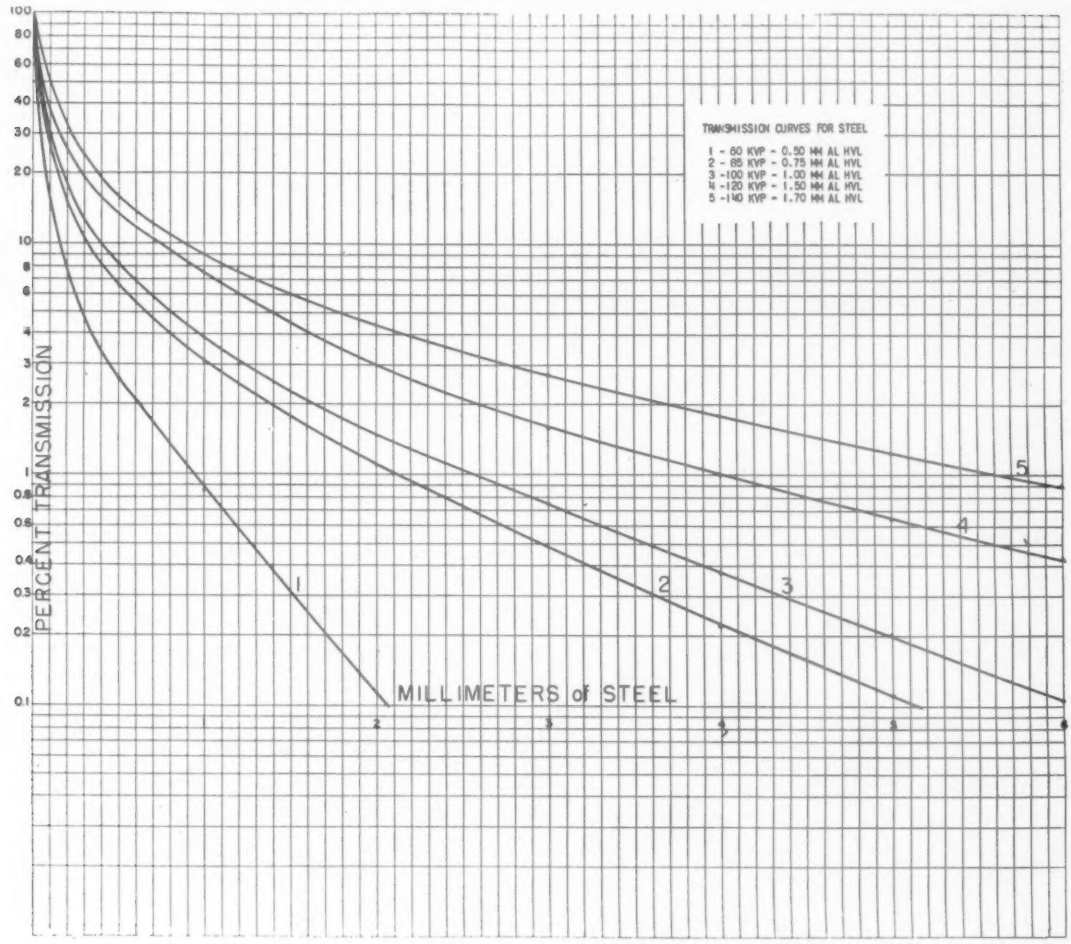

Fig. 6. Transmission curves for steel. 60 to 140 kv. (peak).

Table VII

TRANSMISSION TABLE FOR LEAD GLASS

Kv. (peak)	Half-Value Layer	Per Cent Transmission				
		10	5	1	0.5	0.1
		Millimeters				
140	0.15 mm. Cu	1.1	1.5	3.0	3.7	5.4
140	0.50 mm. Cu	1.0	2.2	4.1	5.0	7.0
200	1.00 mm. Cu	2.2	3.0	5.4	6.8	10.3
250	2.00 mm. Cu	3.2	4.8	9.4	11.5	16.5
250	3.00 mm. Cu	3.5	5.3	10.6	13.0	18.8
400	5.00 mm. Cu	8.5	11.8	20.0	24.0	—
1,000	3.00 mm. Pb	41.0	56.0	95.0	112.0	—

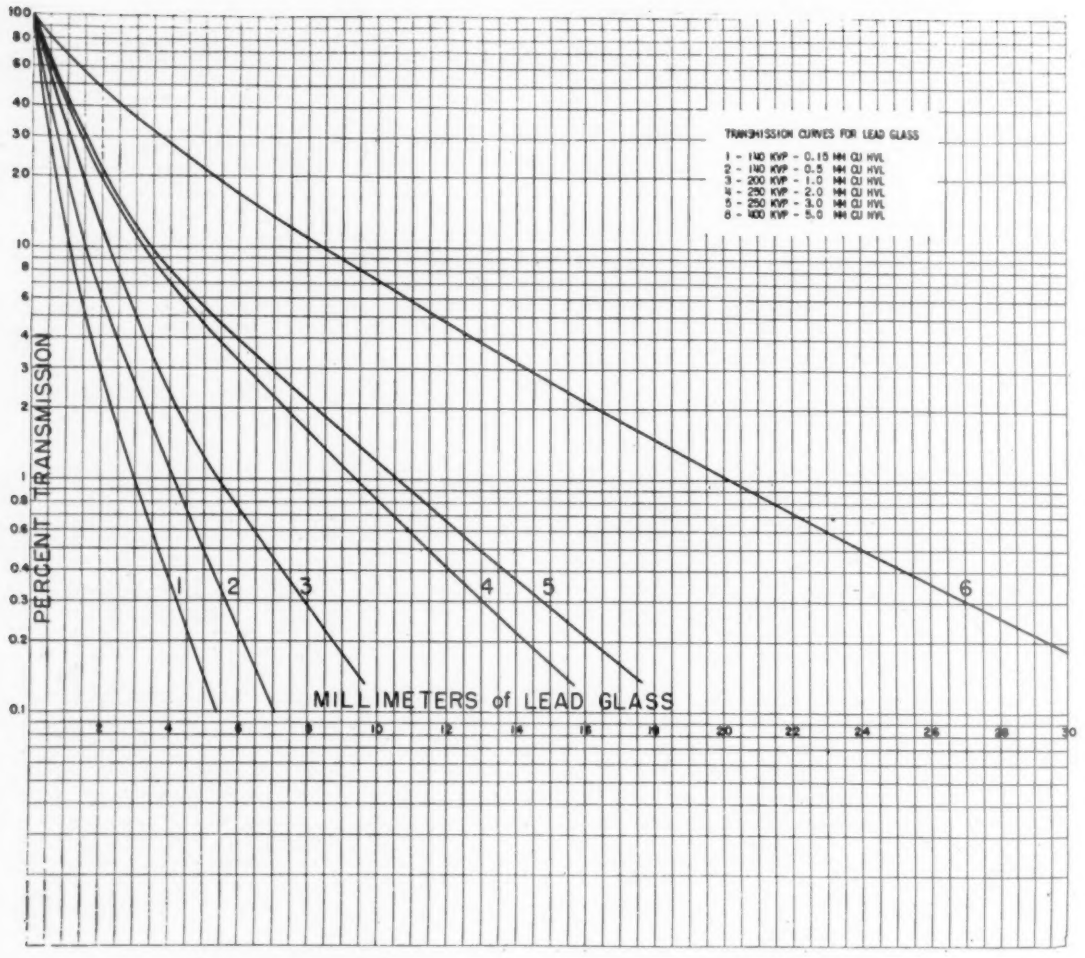
TRANSMISSION CURVES FOR LEAD GLASS
1 - 140 KVP - 0.15 MM CU HVL
2 - 140 KVP - 0.5 MM CU HVL
3 - 200 KVP - 1.0 MM CU HVL
4 - 250 KVP - 2.0 MM CU HVL
5 - 250 KVP - 3.0 MM CU HVL
6 - 400 KVP - 5.0 MM CU HVL
PERCENT TRANSMISSION
MILLIMETERS of LEAD GLASS
1
2
3
4
5
6

FIG. 7. Transmission curves for lead glass. 140 to 400 kv. (peak).

equivalent to 1.9 mm. of lead at 100 kv. and those of maximum thickness were equivalent to 2.3 mm. of lead.

Transmissions have been plotted for direct beams from 60 kv. (peak) to 1,000 kv. (peak).

The problem of viewing windows for 1,000 kv. (peak) installations prompted a study of lead glass where it was subjected to radiation under conditions found in a therapy installation.

In the installation studied, the viewing window was 14 feet from the patient when a vertical beam was used. The height of the window was such as to be about directly in line with the transmission target of the roentgen tube when positioned for a vertical beam and a 70 cm. focal-skin distance. The radiation source was equipped with the roentgen-ray protection and visual localizer regularly supplied. A masonite phantom 30 by 40 cm. and 20 cm. thick was used with the beam diaphragmed to provide a 20 by 20 cm. field.

The window was mounted in an 18 inch concrete wall. The face of the window on the tube side was 6 inches from the face of the concrete so that the concrete diaphragmed the radiation to some extent reducing it to a field about 1 by 2 feet at the lead glass.

The equipment was operated at 1,000 kv.

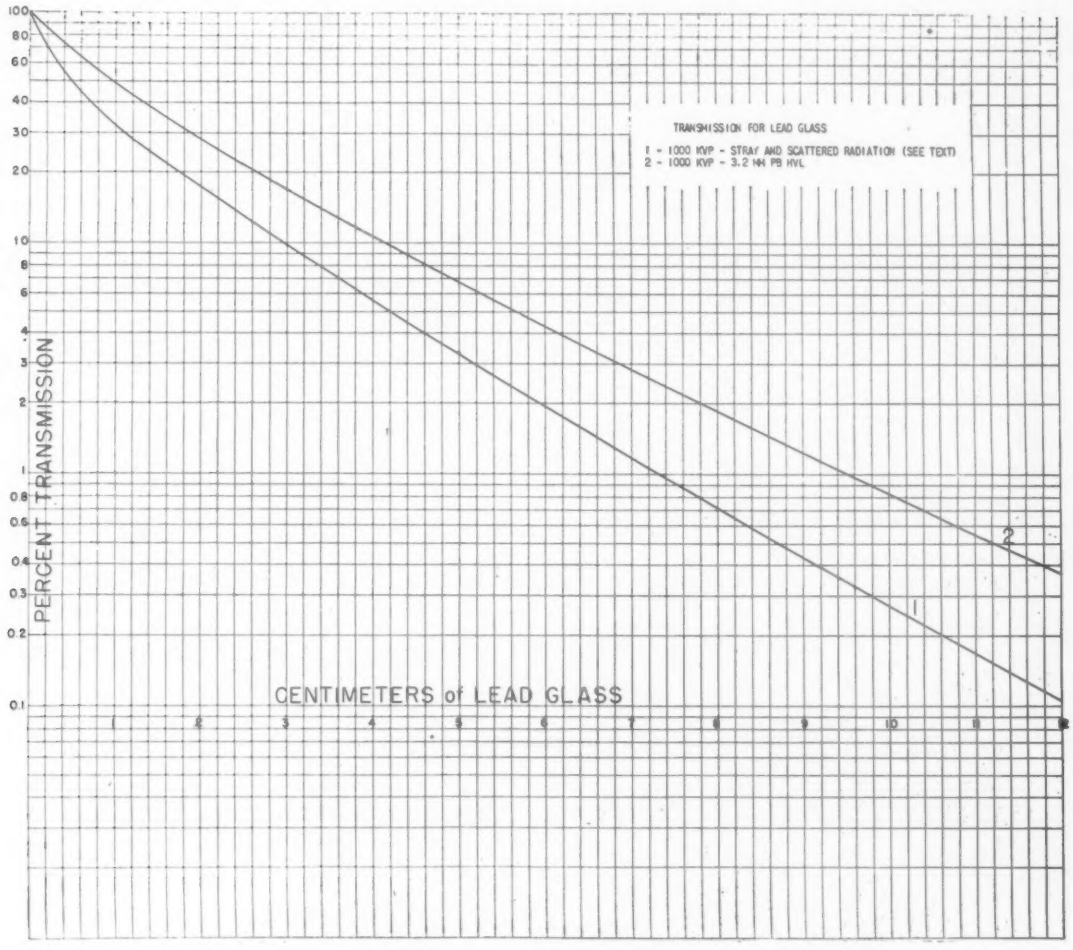

FIG. 8. Transmission curves for lead glass. 1,000 kv. (peak).

TABLE VIII

TRANSMISSION TABLE FOR PLATE GLASS

Kv. (peak)	Half-Value Layer	Per Cent Transmission				
		10	5	1	0.5	0.1
		Millimeters				
60	0.50 mm. Al	4.0	6	15	20	35
85	0.75 mm. Al	5.5	10	26	35	59
100	1.00 mm. Al	7.5	13	35	47	80
120	1.50 mm. Al	11.0	20	47	60	96
140	1.70 mm. Al	13.5	23	50	65	102
140	0.15 mm. Cu	22.5	34	67	82	120
140	0.50 mm. Cu	37.0	51	89	106	—
200	1.00 mm. Cu	49.0	66	111	—	—
250	2.00 mm. Cu	62.0	84	—	—	—
250	3.00 mm. Cu	68.0	91	—	—	—

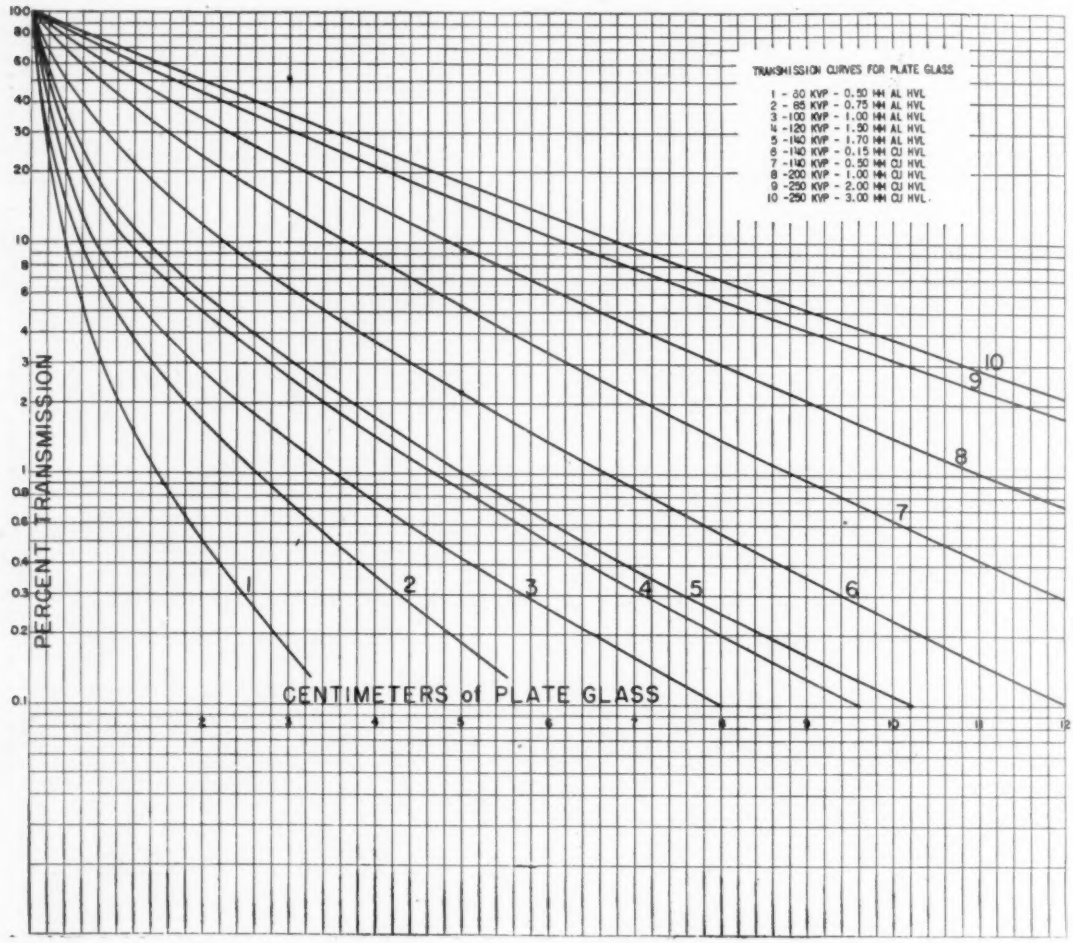
TRANSMISSION CURVES FOR PLATE GLASS
1 - 60 KVP - 0.50 MM AL HVL
2 - 85 KVP - 0.75 MM AL HVL
3 - 100 KVP - 1.00 MM AL HVL
4 - 120 KVP - 1.50 MM AL HVL
5 - 140 KVP - 1.70 MM AL HVL
6 - 140 KVP - 0.15 MM CU HVL
7 - 140 KVP - 0.50 MM CU HVL
8 - 200 KVP - 1.00 MM CU HVL
9 - 250 KVP - 2.00 MM CU HVL
10 - 250 KVP - 3.00 MM CU HVL
PERCENT TRANSMISSION
CENTIMETERS of PLATE GLASS

FIG. 9. Transmission curves for plate glass. 60 to 250 kv. (peak).

(peak) and 3 ma. Under these conditions at 70 cm. the intensity of the beam was 70 roentgens per minute in air or 79 roentgens per minute with backscatter at a half-value layer of 3.5 mm. of lead.

With these factors, the intensity of the stray and scattered radiation was 17.7 milliroentgens per minute (1,060 mr/hr.) at the window face nearer the tube. Three and one-half inches (88 mm.) of lead glass reduced this to 0.1 mr/min. or 6 mr/hr., which was considered safe inasmuch as the equipment was provided with stops, making it possible to position the equipment to bring the beam closer to the viewing window. Vision through the $3\frac{1}{2}$ inches of lead glass was good. As a matter of interest,

TABLE IX

TRANSMISSION TABLE FOR LEAD RUBBER

Kv. (peak)	Half-Value Layer	Per Cent Transmission	
		$\frac{1}{16}$ inch	$\frac{2}{16}$ inch
60	0.50 mm. Al	0.03	—
85	0.75 mm. Al	0.28	—
100	1.00 mm. Al	0.54	—
120	1.50 mm. Al	1.05	0.03
140	1.70 mm. Al	1.50	0.05
140	0.15 mm. Cu	3.30	0.11
140	0.50 mm. Cu	5.00	0.22
200	1.00 mm. Cu	9.50	0.80
250	2.00 mm. Cu	22.50	3.00
250	3.00 mm. Cu	28.00	4.10
400	5.00 mm. Cu	46.00	17.20

transmission was such that excellent photographs were made through a window using medium speed film, a 2.8 aperture and 1/5 second.

Plate Glass. The use of glass-tipped cones has become common practice. The glass used for these small cones is usually pyrex or some similar hard glass. Recently the question of the use of plate glass for viewing windows at low voltages has come up. To get some idea of the absorption of this type of material, curves were plotted for plate glass at working techniques from 60 to 250 kv. (peak).

Plate or hard glass is adequate for the tips of cones for superficial therapy, where most of the diaphragming is done before the radiation strikes the glass. It is advisable to keep the length of the glass portion of the barrel as short as possible.

At low voltages when the viewing window is a considerable distance from the radiation source, plate glass may be satisfactory, but there is little difference in cost between an adequate thickness of plate and a similar size window of $\frac{1}{4}$ inch lead glass.

Design of Beam Definers. One of the problems that faces the designer of beam definers is the question of what constitutes an acceptable dose of radiation outside the treatment field. If the question is put to any considerable number of radiologists, the replies run all the way from doses of a high order to those reminiscent of the old-time stage coach driver who when asked how much clearance he needed to get his coach between canyon walls replied, "Just as little as possible."

Presently the beam defining accessories are usually looked upon as a part of the tube enclosure. Handbook HB20 of the National Bureau of Standards makes recommendations for tube enclosures by specifying the thickness of lead or its equivalent for voltages up to 225 kv. (peak). Above 225 kv. (peak) the recommendation is made that where the tube enclosure is for the "protection of the patient only, the thickness should be sufficient to reduce the transmitted radiation to below 0.1 per cent of the dose normally administered to the patient." No mention is made as to whether this applies to the cones and localizers. This may be a reasonable recommendation for the tube enclosure proper. General opinion among radiologists indicates that for field definers a reasonable transmission would lie somewhere between 5 per cent and 1 per cent.

In any statement involving the protective requirements of the tube enclosure and beam definers, the statement of an acceptable transmission figure must include some clause defining the quality of the roentgen-ray beam. At 250 kv. (peak) stray radiation equivalent to 1 per cent of the unfiltered beam is equivalent to about 6 per cent when the beam is filtered by 3 mm. of copper.

The divergence of opinion as to what represents acceptable protection in a beam limiting system made it necessary to cover transmission from 10 per cent down to 0.1 per cent in compiling tables for ready reference. Accordingly, a set of tables was prepared showing the thickness of material for transmission of 10, 5, 1, 0.5 and 0.1 per cent for the qualities studied.

SUMMARY

Transmission data were taken for lead, brass, steel, lead rubber, lead glass and plate glass over a range of 60 to 2,000 kilovolts peak at various filtrations.

The data have been plotted in the form of graphs for all the conditions studied.

For ready reference, tables have been prepared, showing the thickness of the various protective materials for transmission of 10, 5, 1, 0.5 and 0.1 per cent.

No attempt has been made to list all the references on the subject of protective materials because of the length of such a list. Since this paper was prepared, the National Bureau of Standards has issued Handbook 41, "Medical X-Ray Protection up to Two Million Volts." The subject of permissible radiation through beam definers is covered

very thoroughly.

The characteristics of plate glass for roentgen-ray protection was the subject of a recent report by C. Garrett of the National Research Council of Canada.

The authors wish to acknowledge the able assistance of Mr. Max Deffner and Miss Janet Armstrong, who prepared the graphs.

4855 Electric Ave.
Milwaukee 14, Wis.

Vol. 63, No. 3

DEPARTMENT OF TECHNIQUE

Department Editor: Robert B. Taft, M.D., B.S., M.A., 103 Rutledge Ave. Charleston, S. C.

CASSETTE SUSPENDER FOR PORTABLE CHEST ROENTGENOGRAPHY

By PAUL LIPMAN

FOREST HILLS, LONG ISLAND

As result of increased demand for portable roentgenography, I have devised a means of supporting cassettes for portable chest roentgenography, which I call a cassette suspender.*

This cassette suspender consists of two cassette supporters, each with its own buckle adjustment, attached to a cotton strap, which is applied over the neck or shoulder of a patient. This permits the proper positioning of cassettes for all chest roentgenograms, including posteroanterior, oblique and lateral exposures. It may be used with the patient standing or seated, and will accommodate all sizes of cassettes in either direction. One cassette suspender will serve for all positions in chest roentgenography, with the exception of the lateral view. For lateral views, or for patients unable to support the upper end of the cassette, a second suspender may be used as shown in Figure 5, or any person may hold the cassette against the patient.

This method of cassette suspension is particularly useful where the patient is unsteady, as the *cassette moves with the patient*, and will not show movement on the film as much as would be shown if the cassette were rigidly supported and the patient moved.

* Patent applied for.

Fig. 1. Cassette suspended for right anterior oblique chest exposure.

Fig. 2. Cassette suspended for posteroanterior chest exposure.

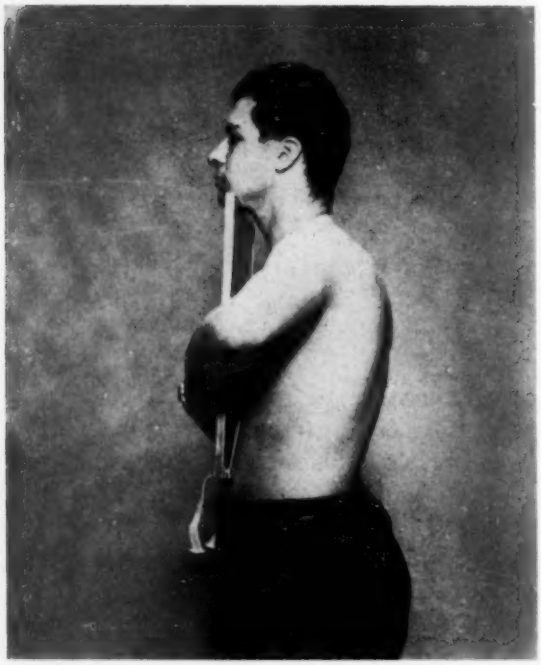

Fig. 3. Cassette suspended for postero-anterior chest exposure.

Fig. 4. Cassette suspended for lateral chest exposure.

Although the cassette suspender was designed for portable and bedside roentgenography of the chest, it will prove useful in other applications. It can be used in the roentgenologist's office for patients who cannot be positioned in front of the cassette changer. Children or babies can be seated

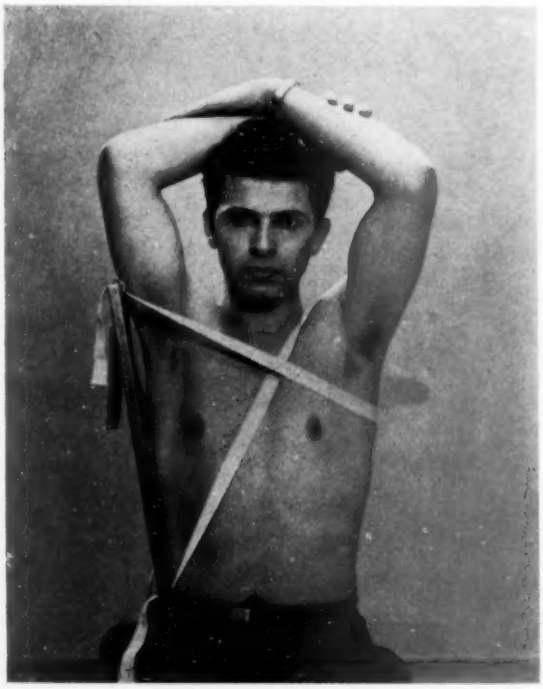

Fig. 5. Cassette suspended for lateral chest exposure. Note second suspender used to support top of cassette.

on the end of the roentgenographic table, and the child and cassette properly positioned and supported by the child's mother with the aid of the suspender. These suspenders provide a simple method of making chest or heart roentgenograms with a vertical roentgenoscope, if required, as positioning and focal-film distance are not restricted by the roentgenoscopic screen holder.

98-120 Queens Blvd.
Forest Hills, Long Island, N. Y.

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AN ADJUSTABLE PRESSURE CONE FOR GASTRIC SPOT ROENTGENOGRAPHY

By A. M. McNABB†, M.D., J. D. ROGER†, M.D., M.R.C.P. (Lond.) F.R.C.P. (C)
Medical Arts Building
OTTAWA, CANADA
and
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National Research Council
OTTAWA, CANADA

A CONE to obtain graded pressure in gastric spot roentgenography has become a standard accessory on most equipment. Numerous ideas have been advanced to vary the cone depth as required for patients of different body types. The expedients include replaceable cones or supplementary pads of gauze or balsa blocks, and in each case the added manipulation tends to delay and interrupt the routine of examination.

The underlying idea of the pressure cone has been to enable the operator to obtain the desired degree of pressure on the underlying viscus and at the same time to maintain a minimum object-film distance irrespective of the type of patient. The adjustable cone about to be described meets these specifications without the inconvenience inherent in other methods. It has a minimum depth of 2 inches in the collapsed position, and extends to a maximum of $3\frac{1}{4}$ inches. All adjustments are readily accomplished in the dark with the gloved hand by rotation of the knurled front rim.

The cone is composed of two sections, the outer being fixed, while the inner may be moved. The clearance is a snug fit of 0.005 inch, thus allowing free movement but preventing binding or tipping. The outer section has two diagonal slots, one on each side, and the bottom of each is notched at regular intervals. The inner section has two projecting studs which travel in the diagonal slots of the outer section. These studs automatically hold the inner section at the desired position by engaging in the

FIG. 1

FIG. 2

† Associated with the Department of Veterans Affairs and the Department of Health and Welfare.

nearest notch in the diagonal slots. The side walls are radiopaque to exclude scattered radiation, and the face is made of plexiglass which is essentially radiolucent. The outside section is firmly fixed to a metal plate which permits attachment to most equipment.

SUMMARY

A cone has been described for use in gastric spot roentgenography which is readily adjustable to varying depths as desired for patients of different body build.

Medical Arts Bldg.
Ottawa, Canada

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Thirty-second Annual Meeting: Roosevelt Hotel, New York, N. Y., May 25–26, 1950.

EDITORIALS

CALCIFICATION AS A DIAGNOSTIC SIGN OF SYPHILITIC AORTITIS

ARTERIOSCLEROSIS is a manifestation of degenerative processes which occur in the human vascular system and within the last few years many experimental studies have been made in an attempt to determine if possible what the causative factors are that bring about these changes. There seems to be a definite relationship between the level of blood cholesterol and the development of atheromatous arterial degeneration.[1] While the experimental work of Anitschkow[2] showed conclusively that lesions resembling human arteriosclerosis could be produced in animals by feeding them with cholesterol in oil, this observation has not proved to be a constant finding for other animals and indeed it is only in the rabbit and chicken that experimental hypercholesteremia consistently induces atheromatous degeneration.

Since Anitschkow's original work, many experimenters have followed his line of investigation and although the experimental evidence relating to the mechanism by which hypercholesteremia leads to atheroma is still somewhat conflicting, some recent clinical studies of Boas and his associates[3] at the Mt. Sinai Hospital in New York produced evidence which suggests strongly a relation in man between hypercholesteremia and atheroma. Stecher and Hersh[4] concluded from their analysis of similar studies that the tendency to develop hypercholesteremia is transmitted as an autosomal dominant gene. If their observations are correct and if man responds to a raised blood cholesterol by formation of atheromatous deposits, then this most prevalent arterial disease would have to be looked upon in many cases as primarily genetically determined.

Whether increased serum cholesterol be an effect of vascular disease and not necessarily its cause is still debatable, but with the intensive work that is being carried on concerning the role of cholesterol in arterial degeneration certain positive information will ultimately be derived from such studies.

While roentgenologists should be interested in the experimental and positive evidence of the part hypercholesteremia plays in atheromatosis, they are constantly aware of its clinical manifestations.

All roentgenologists are familiar with the calcification that may occur in any portion of the aorta; particularly are they familiar with the calcification which is more frequently seen in the aortic knob of older patients in whom the calcification found in that area and in the abdominal area is a manifestation of the aging process associated with hypercholesteremia. However, not all have a knowledge of the significance of calcification seen in the ascending portion of the thoracic aorta, and for a long time calcification in this portion of the aorta was completely misinterpreted or ignored.

It remained for Jackman and Lubert[5] to call attention to the significance of calcification in the ascending arch of the aorta in relation to syphilitic aortitis. Some observers had previously mentioned its pos-

[1] Serum cholesterol and atheroma. *Brit. M. J.*, January 14, 1950, *1*, 109–110.
[2] Anitschkow. Quoted in *Brit. M. J.*[1]
[3] Boas, *et al.* Quoted in *Brit. M. J.*[1]
[4] Stecher and Hersh. Quoted in *Brit. M. J.*[1]

[5] Jackman, J., and Lubert, M. The significance of calcification in the ascending aorta as observed roentgenographically. AM. J. ROENTGENOL. & RAD. THERAPY, 1945, *53*, 432–438.

sible significance, namely, Schatzki[6] who was of the opinion that "calcification of the ascending aorta is more indicative of syphilitic aortitis than against it."

The analysis of the group of cases that Jackman and Lubert reported in this Journal confirmed Schatzki's opinion that calcification seen in the ascending portion of the aorta is of great clinical significance, and Leighton[7] later confirmed the observation of Jackman and Lubert.

More recently Thorner, Carter and Griffith[8] in a report of their analysis of a group of cases that exhibited calcification in the ascending arch of the aorta give additional evidence as to its significance as a factor in the diagnosis of syphilitic aortitis. In atherosclerosis of the aorta the more advanced lesions are usually found in the abdominal portions of the aorta. The thoracic aorta in atherosclerosis is usually less severely affected but may be more or less involved. Atheromatosis usually begins at the mouths of the intercostal arteries and spreads peripherally and the base of the aorta itself is often relatively intact except in extremely severe cases. The real significance of atherosclerosis in relation to syphilitic aortitis has not been generally appreciated in spite of the fact that as early as 1925 Anitschkow[9] pointed out that syphilitic infection of the aortic wall predisposes to the development of atheromatous lesions in the intima; particularly in the late stages of this process this manifestation is often evident. The intima becomes very thick and fibrous, with fatty spots in its depth that tend to disintegrate and to become calcified.

It has long been considered that atheromatosis with calcification of the aorta was a coincidental finding. Boyd[10] was impressed with the frequency with which atheromatous lesions are found in the intima and these observations led him to the thought that although syphilis may not be a direct cause of atheroma it may act as a predisposing factor.

Thorner, Carter and Griffith noted the calcification of the ascending aorta alone, or with calcification of the knob, which appeared with sufficient regularity in a number of cases of syphilitic aortitis that were studied roentgenographically at the Los Angeles County General Hospital, and were stimulated to become interested in its significance. Furthermore they became impressed with the difference in localization of the atheromatosis in the aorta in arteriosclerosis and syphilis and they believed that a demonstration of calcification in the different portions of the aorta should be of value in the differential diagnosis of these two conditions, being familiar with the observations of Schatzki,[6] Sproull[11] and Schwedel[12] particularly that calcification of the aortic arch is due most often to arteriosclerosis although it may be associated with syphilitic aortitis. Schwedel felt that calcification may be considered as evidence of past damage but is not of itself diagnostic of syphilitic aortitis, nor definitely of prognostic significance.

It was the study of Jackman and Lubert that gave conclusive evidence that linear calcification of the ascending arch of the aorta is a valuable sign of syphilitic aortitis.

Thorner, Carter and Griffith in the analysis of their cases which were studied roentgenographically and at postmortem were impressed with the difference in the elective localization of the atheromatosis in the thoracic aorta in syphilis and arteriosclerosis. As the lesions progressed, with the deposition of lime salts in the atheromatous plaques, the roentgenographic demonstration of the presence of calcification in the different portions of the aorta should give valuable clues as to the etiology of the underlying processes. This manifestation is a late sign in syphilitic aortitis

[6] Schatzki. Quoted by Jackman and Lubert.[5]

[7] Leighton, R. S. Calcification of the ascending aorta as a sign of syphilitic aortitis. *Radiology*, 1948, *51*, 257–259.

[8] Thorner, M. C., Carter, R. A., and Griffith, G. C. Calcification as a diagnostic sign of syphilitic aortitis. *Am. Heart J.*, 1949, *38*, 641–653.

[9] Anitschkow. Quoted by Thorner, Carter and Griffith.[8]

[10] Boyd. Quoted by Thorner, Carter and Griffith.[8]

[11] Sproull. Quoted by Thorner, Carter and Griffith.[8]

[12] Schwedel. Quoted by Thorner, Carter and Griffith.[8]

and is of no value in the early diagnosis. The presence of calcification of the ascending aorta in a large percentage of their syphilitic cases as compared with the very low percentage of those exhibiting arteriosclerotic changes makes the roentgenographic demonstration of calcification in the ascending arch of the aorta a very significant factor in the diagnosis of syphilitic aortitis even in the absence of positive serological findings. They pointed out, as had been emphasized by Jackman and Lubert, that since the walls of the aorta are in constant motion, slow exposures which are too frequently used in the roentgenographic examinations of the chest, will blur the calcifications which might be seen in the aorta and make their detection difficult or impossible, and they recommend very rapid exposures of the chest with sufficiently heavy exposure to reveal details in the cardiomediastinal opacity as of great assistance in detecting early the lime salt deposits in the ascending arch of the aorta. The standard posteroanterior position will demonstrate these areas of calcification in almost all positive cases, though frequently a left anterior oblique study may be more satisfactory in the demonstration of these minimal areas of calcification which may occur in the ascending arch of the aorta.

Thorner and his associates also point out that the presence of calcification in the ascending arch of the aorta is of great value in the differential diagnosis of aortic insufficiency as to rheumatic, syphilitic, or arteriosclerotic etiology, that calcification seen in the ascending aorta may be of great value in distinguishing thoracic aneurysms from neoplasms, and that the presence of calcification in the ascending arch of the aorta implies the presence of syphilis "which may swing the balance in favor of the diagnosis of syphilitic aneurysm." This observation, they state, is particularly true of aneurysms of the abdominal aorta, and calcification of the ascending arch of the aorta with abdominal aneurysm helps to establish the syphilitic etiology.

From an analysis of their cases they were led to conclude that linear calcification of the ascending aorta in patients under sixty years of age is due to syphilitic aortitis in a great majority of the cases, and as observed by Jackman and Lubert, when calcification is seen in this location, namely, in the ascending arch of the aorta, that a diagnosis of syphilitic aortitis may be justified even in the presence of negative serological findings and, furthermore, that calcification of the ascending aorta is evidence of late, relatively inactive syphilis, and that the demonstration of calcification in the ascending aorta is a valuable aid in the differential diagnosis of the etiology of aortic insufficiency, and in distinguishing aneurysms from neoplasms.

JOHN HENRY LAMBERT
1875-1949

THE New England Roentgen Ray Society lost one of its few remaining charter members when Dr. John Henry Lambert died on September 10, 1949. Dr. Lambert was also a member of the American Roentgen Ray Society, the American College of Surgeons, past president of the Middlesex North District Medical Society, former president of the Staff of the Lowell General Hospital and at the time of his death was chairman of the Lowell Cancer Committee and director of the Lowell Cancer Clinic.

Dr. Lambert was one of the few remaining physicians whose interests and achievements covered the fields of two separate specialties, radiology and surgery. Primarily a surgeon, and for many years interested particularly in orthopedics, in later years he combined his dual knowledge and skills to good advantage in his cancer work. There is no sounder foundation for the attack upon cancer than a thorough training in surgery and a broad experience in therapeutic irradiation, both of which Dr. Lambert possessed, and both of which he acquired through long, careful, painstaking experience in Lowell.

His interest in radiology and his special ability in that field undoubtedly stemmed from his undergraduate training in physics and mathematics at the Massachusetts Institute of Technology. After receiving his degree in medicine from Boston University Medical School in 1899, he served an internship at the Boothby Surgical Hospital in Boston. When he returned to his native town of Lowell in 1900, he was appointed to the staff of the Lowell General Hospital where he was named roentgenologist and assistant surgeon six years later. In 1916 he was made senior surgeon and for several years was president of the staff.

As an individual Dr. Lambert was known as a firm and forceful speaker, demanding complete honesty from others as well as from himself, and demonstrating by his example the value of high ideals and sound

John Henry Lambert

basic principles. He attended nearly all of his local district medical society meetings, and also the regional meetings of the New England Roentgen Ray Society until his disabling motor and sensory paralysis curtailed his activities. It was always a pleasure to hear him puncture the pretenses of a too enthusiastic speaker as well as to hear his quiet commendation of work well done. The guiding principle of his long professional career seemed always to be the welfare of his patient, and he was loved,

honored and respected by the people of Lowell for his labors.

Dr. Lambert was a vital citizen of his New England community, spending much of his spare time constructively in civic affairs. He was at one time chairman of the Lowell School Committee, medical adviser to the Lowell Chapter of the American Red Cross, chairman of the building committee of the Lowell High School in 1919, and throughout his life actively engaged in work for the Lowell Council of the Boy Scouts of America, having been former president of the council, and at the time of his death chairman of the camp committee.

Dr. Lambert's avocations were those of the outdoors. In addition to his Boy Scout activities and an earlier interest in sailing, he was a member of the Appalachian Mountain Club, spending many of his summer vacations mountain climbing, later enjoying horse-back riding, and then during his long illness which inhibited physical activity, obtaining vicarious pleasure through his activities in the Boy Scout council. It was fitting that he should die in his summer home at Holderness, New Hampshire, where he had spent so many summers studying nature in all of its moods.

Dr. Lambert is survived by his wife, the former Mabel Forrest, whom he married in 1902; three daughters, and two sons, one of whom, Benjamin de F. Lambert, is following his father's footsteps in surgery. At the time of his death, Dr. Lambert was senior surgeon and radiologist of the John H. Lambert Medical Associates which was organized during the last year of his life. Surviving him also are nine grandchildren and a host of grateful and devoted patients.

In these days of rapid change and frequent replacements of equipment, it is interesting to learn that Dr. Lambert's first fluoroscope, originally used by Walter Dodd at the Massachusetts General Hospital, was still in use in his office at the time of his death. His colleagues in the medical profession of Lowell, his fellow members in the medical societies, and his many patients and friends mourn the passing of a good physician.

M. C. Sosman, M.D.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

American Roentgen Ray Society
Secretary, Dr. Barton R. Young, Germantown Hospital, Philadelphia 44, Pa. Annual meeting: Jefferson Hotel, St. Louis, Mo., Sept. 26–29, 1950.

American Radium Society
Secretary, Dr. H. F. Hare, 605 Commonwealth Ave., Boston, Mass. Annual meeting: Roosevelt Hotel, New York, N. Y., May 25–26, 1950.

Radiological Society of North America
Secretary, Dr. D. S. Childs, 607 Medical Arts Bldg., Syracuse, N.Y. Annual meeting: 1950, to be announced.

American College of Radiology
Executive Secretary, William C. Stronach, 20 N. Wacker Drive, Chicago 6. Annual meeting: 1950, to be announced.

Section on Radiology, American Medical Association
Secretary, Dr. Paul C. Hodges, 950 E. 59th St., Chicago, Ill. Annual Meeting: San Francisco, Calif., June 26–30, 1950.

Alabama Radiological Society
Secretary, Dr. W. W. Anderson, Tuscaloosa, Ala. Meets time and place Alabama State Medical Association.

Arizona Association of Pathologists and Radiologists
Secretary, Dr. R. Lee Foster, 507 Professional Bldg., Phoenix, Ariz. Two regular meetings a year. The annual meeting at time and place of State Medical Association and interim meeting six months later.

Arkansas Radiological Society
Secretary, Dr. Fred Hames, 511 National Bldg., Pine Bluff, Ark. Meets every three months and also at time and place of State Medical Association.

Atlanta Radiological Society
Secretary, D. W. W. Bryan, 490 Peachtree St., N.E., Atlanta, Ga. Meets monthly, except during three summer months, on second Friday evening.

Brooklyn Roentgen Ray Society
Secretary, Dr. J. J. Daversa, 345 75th St., Brooklyn, N. Y. Meets monthly fourth Tuesday, Oct. through April.

Buffalo Radiological Society
Secretary, Dr. Mario C. Gian, 610 Niagara St., Buffalo, N. Y. Meets second Monday evening each month, October to May inclusive.

Central New York Roentgen Ray Society
Secretary, Dr. Dwight V. Needham, 608 E. Genesee St., Syracuse N. Y. Meets January, May, November.

Central Ohio Radiological Society
Secretary, Dr. Paul D. Meyer, Grant Hospital, Columbus, Ohio. Meets at 6:30 P.M. on second Thursday of October, December, February, April, and June at Seneca Hotel, Columbus, Ohio.

Chicago Roentgen Society
Secretary, Dr. John H. Gilmore, 720 N. Michigan Ave., Chicago 11, Ill. Meets second Thursday of each month October to April inclusive at the University Club.

Cincinnati Radiological Society
Secretary, Dr. E. C. Elsey, 927 Carew Tower, Cincinnati 2, Ohio. Meets last Monday of each month, September to May, inclusive.

Cleveland Radiological Society
Secretary, Dr. J. R. Hannan, Cleveland Clinic, Cleveland 6, Ohio. Meetings at 6:30 P.M. on fourth Monday of each month from October to April.

Colorado Radiological Society
Secretary, Dr. Paul E. RePass, 306 Republic Bldg., Denver 2, Colo. Meets third Friday of each month at University of Colorado Medical Center or at Denver Athletic Club.

Connecticut Valley Radiologic Society
Secretary, Dr. E. W. Godfrey, 1676 Boulevard, West Hartford, Conn. Meets second Friday Oct. and April.

Dallas-Fort Worth Roentgen Study Club
Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

Detroit Roentgen Ray and Radium Society
Secretary, Dr. W. G. Belanger, Harper Hospital. Meets monthly on first Thursday from October to May, at Wayne County Medical Society Building.

East Bay Roentgen Society
Secretary, Dr. Dan Tucker, 434-30th St., Oakland 9, Calif. Meets first Thursday each month at Peralta Hospital, Oakland.

Florida Radiological Society
Secretary, Dr. F. K. Hurt, Riverside Hospital, Jacksonville, Fla. Meets twice annually, in the spring with the annual State Society meeting, and in the fall.

Georgia Radiological Society
Secretary, Dr. Robert Drane, DeRenne Apartments, Savannah, Ga. Meets in mid-winter and at annual meeting of Medical Association of Georgia in the spring.

Greater Miami Radiological Society
Secretary, Dr. David Kirsh, 712 duPont Bldg., Miami 32, Florida. Meets last Wednesday of each month at 8:00 P.M. at Veterans Administration Regional Office.

Houston X-ray Club
Secretary, Dr. Curtis H. Burge, 3020 San Jacinto St. Houston 4, Texas. Meets fourth Monday each month.

Radiological Society of Kansas City
Secretary, Dr. Arthur B. Smith, 800 Argyle Bldg., Kansas City, Mo. Meets third Thursday of each month.

Illinois Radiological Society
Secretary, Dr. Wm. DeHollander, St. John's Hospital, Springfield, Ill. Meets three times a year.

Indiana Roentgen Society
Secretary, Dr. William M. Loehr, 712 Hume-Mansur Bldg., Indianapolis 4. Meets second Sunday in May.

Iowa X-Ray Club
Secretary, Dr. Arthur W. Erskine, 326 Higley Bldg., Cedar Rapids, Iowa. Luncheon and business meeting during annual session of Iowa State Medical Society. Special meetings by announcement.

Kansas Radiological Society
Secretary, Dr. Anthony F. Rossitto, Wichita Hospital, Wichita, Kan. Meets annually with State Medical Society.

Kentucky Radiological Society
Secretary, Dr. W. C. Martin, 321 W. Broadway, Louisville. Meets annually in Louisville on first Saturday in Apr.

Kings County Radiological Society
Secretary, Dr. Marcus Wiener, 1430-48th St., Brooklyn, N. Y. Meets Kings County Med. Soc. Bldg. monthly on fourth Thursday, October to May, 8:45 P.M.

Los Angeles Radiological Society
Secretary, Dr. Wybren Hiemstra, 1414 S. Hope St., Los Angeles 15, Calif. Meets second Wednesday each month at Los Angeles County Medical Assn. Building.

Louisiana Radiological Society
Secretary, Dr. J. R. Anderson, 1130 Louisiana Ave., Shreveport. Meets annually during Louisiana State Medical Society Meeting.

* Secretaries of societies are requested to send timely information promptly to the Editor.

Louisville Radiological Society
Secretary, Dr. E. L. Pirkey, Louisville General Hospital, Louisville 2, Ky. Meets monthly on second Friday at Seelbach Hotel, Louisville.

Michigan Association of Roentgenologists
Secretary, Dr. R. D. McDuff, 220 Genesee Bank Bldg., Flint 3, Mich.

Milwaukee Roentgen Ray Society
Secretary, Dr. T. J. Pfeffer, 839 N. Marshall St., Milwaukee 2, Wis. Meets monthly on second Monday at University Club.

Minnesota Radiological Society
Secretary, Dr. Chauncey N. Borman, 802 Medical Arts Bldg., Minneapolis 2, Minn. Two meetings yearly, one at time of Minn. State Med. Assn., the other in the fall.

Nebraska Radiological Society
Secretary, Dr. Ralph C. Moore, Nebraska Methodist Hospital, Omaha 3, Nebr. Meets third Wednesday of each month, at 6 P.M. at either Omaha or Lincoln.

New England Roentgen Ray Society
Secretary, Dr. George Levene, Massachusetts Memorial Hospitals, Boston, Mass. Meets monthly on third Friday, Harvard Club.

New Hampshire Roentgen Ray Society
Secretary, Dr. A. C. Johnston, Elliott Community Hospital, Keene, N. H. Meets four to six times yearly.

New York Roentgen Society
Secretary, Dr. F. H. Ghiselin, 111 East 76th St., New York 21, N. Y. Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

North Carolina Radiological Society
Secretary, Dr. J. E. Hemphill, 1420 E. Fifth St., Charlotte 4, N. C. Meets in May and October.

North Dakota Radiological Society
Secretary, Dr. C. O. Heilman, 807 Broadway, Fargo. Meetings by announcement. Annual session with State Medical Society in May, 1950, at Grand Forks, N.D.

Northern California Radiological Club
Secretary, Dr. R. L. Ayers, 726 4th St., Marysville, Calif. Meets at dinner last Monday, every second month, except June, July and August.

Ohio State Radiological Society
Secretary, Dr. E. C. Elsey, 927 Carew Tower, Cincinnati 2, Ohio.

Oklahoma State Radiological Society
Secretary, Dr. W. E. Brown, Tulsa, Okla. Three regular meetings annually.

Oregon Radiological Society
Secretary, Dr. Selma Hyman, Univ. of Oregon Medical School, Portland, Oregon. Meets monthly 2nd Wednesday, 8:00 P.M.

Orleans Parish Radiological Society
Secretary, Dr. Joseph V. Schlosser, Charity Hospital, New Orleans 13, La. Meets first Tuesday of each month.

Pacific Northwest Radiological Society
Secretary, Dr. S. J. Hawley, 1320 Madison St., Seattle 4, Wash. Meets annually in May.

Pacific Roentgen Society
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

Pennsylvania Radiological Society
Secretary, Dr. J. M. Converse, 416 Pine St., Williamsport. Annual Meeting: Penn Harris Hotel, Harrisburg, Pa., May 12–13, 1950.

Philadelphia Roentgen Ray Society
Secretary, Dr. G. P. Keefer, 1930 Chestnut St. Meets first Thursday each month October to May, at 8:00 P.M., in Thomson Hall, College of Physicians.

Pittsburgh Roentgen Society
Secretary Dr. E. J. Euphrat, 3500 Fifth Ave., Pittsburgh 13, Pa. Meets 6:30 P.M. at Webster Hall Hotel on second Wednesday each month, October to May inclusive.

Queens Roentgen Ray Society
Secretary, Dr. J. E. Goldstein, 88-29 163rd St., Jamaica 3, N. Y. Meets fourth Monday of each month except during the summer.

Radiological Section, Baltimore Medical Society
Secretary, Dr. Harry A. Miller, 2452 Eutaw Place, Baltimore. Meets third Tuesday each month, Sept. to May.

Radiological Section, Connecticut Medical Society
Secretary, Dr. Fred Zaff, 135 Whitney Ave., New Haven, Conn. Meets bimonthly on second Wednesday.

Radiological Section, District of Columbia Medical Society
Secretary, Dr. K. C. Corley, 1835 Eye St., N. W., Washington, D. C. Meets Medical Society Auditorium, third Thursday, Jan., March, May, Oct. at 8:00 P.M.

Radiological Section, Southern Medical Association
Secretary, Dr. Roy G. Giles, Temple, Texas.

Radiological Society of New Jersey
Secretary, Dr. Benjamin Copleman, 280 Hobart St., Perth Amboy, N. J. Meets annually at Atlantic City at time of State Medical Society and mid-winter at Elizabeth, N. J.

Rochester Roentgen Ray Society, Rochester, N. Y.
Secretary, Dr. A. V. Winchell, 40 Meigs St., Rochester, N. Y. Meets monthly on last Monday from September through May, 8 P.M. at Strong Memorial Hospital.

Rocky Mountain Radiological Society
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr.

St. Louis Society of Radiologists
Secretary, Dr. C. J. Nolan, 737 University Club Bldg., St. Louis 3, Mo. Meets fourth Wednesday each month, except June, July, August, and September.

San Diego Roentgen Society
Secretary, Dr. R. F. Niehaus, 1831 Fourth Ave., San Diego, Calif. Meets monthly, first Wednesday at dinner.

Section on Radiology, California Medical Association
Secretary, Dr. D. R. MacColl, 2007 Wilshire Blvd., Los Angeles 5, Calif.

Section on Radiology, Illinois State Medical Society
Secretary, Dr. Harold L. Shinall, St. Joseph's Hospital, Bloomington, Ill.

Shreveport Radiological Club
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

South Carolina X-Ray Society
Secretary, Dr. T. A. Pitts, Baptist Hospital, Columbia, S. C. Meets in Charleston first Thursday in November, also with South Carolina State Medical Association.

Tennessee Radiological Society
Secretary, Dr. J. M. Frère, 707 Walnut St., Chattanooga, Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

Texas Radiological Society
Secretary, Dr. R. P. O'Bannon. 650 Fifth Ave., Fort Worth 4, Texas. Next meeting, Dallas, Texas, February 3 and 4, 1950.

University of Michigan Department of Roentgenology Staff Meeting
Meets each Monday evening from September to June, at 7 P.M. at University Hospital.

University of Wisconsin Radiological Conference
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 P.M., September to May inclusive. Room 203, Service Memorial Institute, 426 N. Charter St., Madison.

Utah State Radiological Society
Secretary, Dr. Angus K. Wilson, 343 S. Main St., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.

Virginia Radiological Society
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.

Washington State Radiological Society
Secretary, Dr. J. H. Walker, 1115 Terry Ave., Seattle 1, Wash. Meets fourth Monday each month, October through May, College Club, Seattle.

Wisconsin Radiological Society
Secretary, Dr. Irving I. Cowan, 425 E. Wisconsin Ave., Milwaukee 2, Wis. Special meetings held during year; annual meeting each spring at Madison, Wis.

X-Ray Study Club of San Francisco
Secretary, Dr. W. F. Reynolds, University of California Hospital, San Francisco. Meets from January to July at Lane Hall, Stanford University Hospital, and from July to December at San Francisco Hospital.

Cuba

Sociedad de Radiología y Fisioterapia de Cuba
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

Mexico

Sociedad Mexicana de Radiologia y Fisioterapia
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Ordinary meeting, on the Thursday preceding the third Friday, October to May at 8:15 p.m.
Medical Members' meeting, on third Friday in each month at 5:00 p.m., 32 Welbeck St., London, W 1.

Faculty of Radiologists
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.

Section of Radiology of the Royal Society of Medicine (Confined to Medical Members)
Meets third Friday each month at 4:45 p.m. at the Royal Society of Medicine, 1 Wimpole St., London.

Canadian Association of Radiologists
Honorary Secretary, Dr. E. M. Crawford, 1535 Sherbrooke St., West, Montreal 26, Que. Meetings January and June.

Section of Radiology, Canadian Medical Association
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.

Société Canadienne-Française d'Electrologie et de Radiologie Médicales
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.

Australian and New Zealand Association of Radiologists
Honorary Secretary, Dr. Alan R. Colwell, 135 Macquarie St., Sydney, N.S.W.
Honorary Secretaries, State Branches:
New South Wales, Dr. E. W. Frecker, 135 Macquarie St., Sydney.
Victoria, Dr. T. I. Tyrer, 3 Lockerbie Court, East St. Kilda.
Queensland, Dr. J. Adam, 131 Wickham Terrace, Brisbane.
South Australia, Dr. R. de G. Burnard, 170 North Terrace, Adelaide.
Western Australia, Dr. A. M. Nelson, 179-B St. Georges Terrace, Perth.
New Zealand, Dr. E. G. Lynch, 12 Bolton St., Wellington.

South America

Sociedad Argentina de Radiologia
Secretary, Dr. Guido Gotta, Buenos Aires, Argentina. Meetings are held monthly.

Sociedad Argentina de Radiología, Filial del Litoral
President, Dr. Francisco P. Cifarelli. Meets monthly second Wednesday, 7:00 p.m., 663 Italia St., Rosario.

Sociedade Brasileira de Radiologia Medica
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.

Sociedade Brasileira de Radioterapia
Secretary, Dr. Oscar Rocha von Pfuhl, Av. Brigadeiro Luiz Antonio, 644 São Paulo, Brazil. Meets monthly on second Wednesday at 9 p.m. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.

Sociedad Peruana de Radiologia
Secretary, Dr. Julio Bedoya Paredes, Apartado, 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A. Carrión," Villalta, 218, Lima.

Sociedad de Radiologica, Cancerologia y Fisica Medica del Uruguay
Secretary, Dr. Arias Bellini.

Continental Europe

Société Belge de Radiologie
General Secretary, Dr. S. Masy, 111 Avenue des Alliés, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.

Ceskoslovenská společnost pro röntgenologii a radiologii v Praze
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland.

Gdansk Section, Polish Society of Radiology
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10.30, X-Ray Dept., Akademia Gdansk.

Warsaw Section, Polish Society of Radiology
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Meets monthly.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Oscar Meller, Str. Banual Mărăcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad.
USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

Leningrad Roentgen Ray Society
Secretaries, Drs. S. G. Simonson and G. A. Gusterin. Meets monthly, first Monday at 8 o'clock, State Institute of Roentgenology and Radiology, Leningrad.

Moscow Roentgen Ray Society
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky. Meets monthly, first Monday, 8 p.m.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

Sociedad Espanola de Radiologia y Electrologia
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

Schweizerische Röntgen-Gesellschaft (Société Suisse de Radiologie)
Secretary, Dr. Max Hopf, Effingerstrasse 47, Bern, Switzerland.

Societa Italiana di Radiologia Medica
Secretary, Prof. Mario Ponzio, Ospedale Mauriziano. Torino, Italy. Meets biannually.

Eastman Kodak Co.

Dr. E. P. McNamee (right), President of the Radiological society of North America and Dr. U. V. Portmann, President of the American Roentgen Ray Society, both of Cleveland, Ohio, taken at the banquet of the Radiological Society on December 8, 1949, during the meeting held in Cleveland.

REGISTRY OF RADIOLOGIC PATHOLOGY

The Registry of Radiologic Pathology, sponsored by the American College of Radiology, the American Roentgen Ray Society, and the Radiological Society of North America, at the Armed Forces Institute of Pathology, Washington, D. C., offers an appointment for study and correlation of the voluminous roentgenologic and pathologic material at the Institute under the supervision of skilled pathologists and well known teachers of clinical radiology who act as visiting consultants.

Appointments begin on October 1, January 1, April 1, and July 1, all for a period of six months each, and carry a stipend of $250.00 per month.

Applicants for this appointment must have completed a *minimum* of two years of training in an approved Residency in Radiology, preferably with six months of pathology. Under certain circumstances, the latter requirement may be waived. Preference will be given to applicants who have completed an approved residency in Radiology or are eligible for the American Board of Radiology examination.

For further information apply to Aubrey O. Hampton, M.D., Secretary, Inter-Society Committee for the Registry of Radiologic Pathology, Garfield Memorial Hospital, 10th and Florida Ave. N. W., Washington, D. C.

BASIC RADIOISOTOPE TECHNIQUES COURSES

The Special Training Division of the Oak Ridge Institute of Nuclear Studies will conduct the fifteenth, sixteenth, and seventeenth in its series of basic radioisotope techniques courses this summer. Dates for the courses are June 5–30, July 3–28, and July 31-August 25, 1950. Priority will go to university personnel who have difficulty attending courses offered during the winter months. The courses are open to senior research personnel.

Thirty-two participants will be accepted for each of the three repeated courses. This number is dictated by the laboratory facilities available for use in the courses.

Each session is comprised of laboratory work, lectures on laboratory experiments, general background lectures, and special topic seminars. Experiments cover the use and calibration of instruments and purification and separation procedures, as well as the application of a number of radioisotope techniques. Seminars include such discussions as the use of radioisotopes in animal and human experimentation, principles and practices of health physics, design of radiochemical laboratories, dosimetry, instrumentation, and radiation effects on cells.

A registration fee of $25.00 is charged for the course. Dormitory or hotel facilities are available in Oak Ridge for participants.

Application forms and additional information on the courses may be obtained from Dr. Ralph T. Overman, Chairman, Special Training Division, Oak Ridge Institute of Nuclear Studies, P. O. Box 117, Oak Ridge, Tennessee.

UNITS OF RADIOACTIVITY

In November, 1947, a joint committee of the Divisions of Chemistry and Chemical Technology and of Mathematical and Physical Sciences of the National Research Council was appointed to make recommendations regarding standards and units of radioactivity. This committee unanimously adopted the recommendations quoted below. The committee would like to point out that these recommendations effectively divorce the curie from the disintegration rate of radium by assigning to the former an arbitrary magnitude (3.7×10^{10} dis/sec) approximately equal to the disintegration rate of radium. This arbitrary figure is therefore not influenced by any future revisions of the generally accepted disintegration rate of radium. This recommendation has been submitted to the Joint Commission on Standards, Units, and Constants of Radioactivity of the International Unions of Chemistry and Physics for the purpose of obtaining international agreement.

This changes, slightly, the meaning of the curie when applied to radium. For example 1 curie of radon is no longer, on the basis of these recommendations, the amount in equilibrium with 1 gram of radium, but is the amount undergoing 3.7×10^{10} disintegrations per second. Similarly, 1 mg. and 1 mc. of radium are no longer rigorously synonymous. This distinction has a number of precedents in physics; for example, the international ampere, now abolished, was not quite equal to the absolute ampere and the angstrom unit is nearly, but not quite, equal to 1000 x-units (x-unit is defined as 10^{-11} cm.).

"*curie*

The curie should be defined as that quantity of any radioactive species (radioisotope) undergoing exactly 3.700×10^{10} disintegrations per second."

"*rutherford*

The rutherford should be defined as that quantity of any radioactive species (radioisotope) undergoing 10^6 disintegrations per second."

"*rhm*

For the quantitative comparison of radioactive sources emitting gamma rays, for which disintegration rates cannot be determined, the *roentgen per hour at one meter* (rhm) is recommended. This is not essentially a new unit since all units involved are well established, explicitly defined, and are in common usage."

The recommendation of this latter unit is a practical step to insure that, by its use, gamma-ray measurements are so made with instruments and under such conditions that measurements on a given isotope (nuclear species) made in any laboratory will be directly comparable with similar measurements made in other laboratories. This will result, if the procedures used comply with the definition of the unit; that is, a source is 1 rhm if it produces 1 roentgen per hour at a distance of 1 meter.

L. F. Curtiss, *Chairman*
R. D. Evans
Warren Johnson
Glenn T. Seaborg

We are informed that the radiological physicists most closely associated with the problems attendant upon the use of radioactive materials are opposed to any changes in radioactivity units used by the radiologists. It is their preference to retain the use of the curie with an assigned value for the number of disintegrations per second. We are also informed that the National Bureau of Standards has recently discontinued the use of the rutherford in its certificates and publications. It is felt therefore that the rutherford is not presently acceptable for use by radiologists.—Ed.

DAVID ANDERSON-BERRY PRIZE (1950)

Second Notice

A David Anderson-Berry Silver-Gilt Medal, together with a sum of money amounting to about £100, will be awarded during 1950 by the Royal Society of Edinburgh to the person who, in the opinion of the Council, has recently produced the best work on the therapeutic effect of roentgen

rays on human diseases. Applications for this prize are invited. They may be based on both published and unpublished work and should be accompanied by copies of the relevant papers.

Applications must be in the hands of the General Secretary, Royal Society of Edinburgh, 22 George Street, Edinburgh 2, not later than March 31, 1950.

DR. H. D. KERR VISITING PROFESSOR

Dr. H. Dabney Kerr, University Hospital, Iowa City, Iowa, will be Visiting Professor of Therapeutic Radiology under the auspices of the Commonwealth Fund for the week beginning April 17, 1950, at the University of Louisville School of Medicine, Louisville, Kentucky.

DR. L. G. RIGLER TO DELIVER JOSEPH FREEDMAN LECTURES

On Saturday and Sunday, April 29 and 30, 1950, Dr. Leo G. Rigler, Professor of Radiology at the University of Minnesota School of Medicine, will deliver the second annual Joseph Freedman Lectures on Diagnostic Roentgenology at the University of Cincinnati College of Medicine. Roentgenologists desiring to attend are requested to write Dr. Benjamin Felson, X-Ray Department, Cincinnati General Hospital, Cincinnati, Ohio, for further details.

SEGUNDO CONGRESO DE RADIOLOGÍA

The Second Congress of Radiology (Segundo Congreso de Radiología) will be held in Tucumán, Argentina, May 26–31, 1950, under the auspices of the Radiological Association of Argentina (Asociación radiológica de Argentina) and the University of Tucumán (Universidad de Tucumán). Participating in the meeting will be the Radiological Society of Chile (Sociedad de Radiología de Chile); the Radiological Institute of Uruguay (Instituto de Radiología del Uruguay); the Brazilian Society of Radiology (Sociedad brazilera de Radiología); and the Chair of Radiology of Paraguay University (Cátedra de Radiología del Paraguay).

The Executive Committee, headed by Dr. Sabina Di Rienzo, President, and Dr. Lidio G. Mosca, Secretary, have announced these official themes for the Congress:

Nomenclature of bronchial and segmental architecture

Tumors of the colon

Tumors of the esophagus

A fourth session will be devoted to various other topics related to roentgen diagnosis and therapy.

ROCHESTER ROENTGEN RAY SOCIETY

At the annual meeting of the Rochester (New York) Roentgen Ray Society held in December, 1949, the following officers were elected for the ensuing year: *President*, Dr. E. Forrest Merrill; *Vice-President*, Dr. Ralph E. Alexander; *Secretary-Treasurer*, Dr. A. Vaughn Winchell, all of Rochester. Meetings are held on the last Monday of each month from September through May at the Strong Memorial Hospital.

SIXTH INTERNATIONAL CONGRESS OF RADIOLOGY, JULY 23–30, 1950

It has been decided to extend until April 1, 1950, the date by which offers of papers to be read before the Congress must be submitted. Such offers must be accompanied by the abstract and the application for registration as a member of the Congress, and should be sent to the Secretary-General, 45 Lincoln's Fields, London, W.C.2, England.

BOOK REVIEWS

Books sent for review are acknowledged under: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interest of our readers as space permits.

NEURORADIOLOGY. By Alexander Orley, M.D., F.F.R., D.M.R.&E., Hon. Consulting Radiologist, West End Hospital for Nervous Diseases, London. Cloth. Price, $11.50. Pp. 436, with 512 illustrations. Springfield, Illinois: Charles C Thomas, 1949.

Neuroradiology is one of the youngest disciplines in the general field of medicine, and "Neuroradiology" by Alexander Orley has the distinction of being the first textbook entirely devoted to this field. The author's conception of the field is broad, including roentgenography of the skull and spine, penumoencephalography, cerebral angiography, myelography and peripheral roentgenography, as well as peripheral angiography in relation to neuropathic diseases. He speaks with authority based upon a large personal experience and an intimate knowledge of the work of others as evidenced by an impressive bibliography of 842 titles. Quite appropriately a considerable portion of the book is devoted to descriptions of techniques and the recognition of normal variations in the skull and spine. The wide range of subjects evidently prevented an exhaustive discussion of any of them, and some of the rarer conditions receive only brief mention. The 572 illustrations are well reproduced. Unfortunately, the majority of the roentgenograms appear as positives. Had the additional step been taken in their preparation to have them appear as negatives, they would strike a more familiar note to the American reader who is accustomed to read his roentgenograms from the negative. However, the book forms a solid foundation upon which to build and will prove invaluable to the beginner. It should be in the library of every roentgenologist and the roentgen department of every hospital.

LEO M. DAVIDOFF, M.D.

LUNG DUST LESIONS VERSUS TUBERCULOSIS. By Lewis Gregory Cole, M.D., F.A.C.R. Cloth. Pp. 474, with over 450 illustrations. White Plains: American Medical Films, Inc., 1948.

This book is one of the most unusual that the reviewer has ever had an opportunity to study. The author, an internationally known radiologist, has extended his study beyond the bounds of his own specialty and critically discusses the pathology and chemistry of silicosis. His approach to the problem has not been along conventional lines; in fact, he is critical of those who have pursued the subject along such conventional lines, and throughout the book he has developed his own thesis concerning silicosis.

In reviewing this book, it has been somewhat difficult to evaluate the statements of the author because they are not in agreement with the generally accepted concepts of the disease. While it may be true that the author is correct in stating that some of the present concepts concerning the relationship of SiO_2 to the development of silicosis may not be tenable, the reviewer does not feel that one can justifiably support any other thesis on the basis of the material discussed in the book. It is well recognized by all workers in pneumoconiosis that there are many phases of the subject that are incompletely explained. The subject is very much better understood today than it was years ago, and any additional light that may be shed upon so difficult a subject is welcome.

The book is beautifully illustrated throughout. Some of the pen and pencil drawings and the artist's drawings are magnificent. The reviewer, however, freely admits that he is unable to understand either the philosophy or the logic of the author in his presentation of many of the points in which the author is at variance with the concept of others.

E. P. PENDERGRASS, M.D.

HISTOPATHOLOGY OF THE SKIN. By Walter F. Lever, M.D., Instructor in Dermatology, Harvard Medical School; Assistant Dermatologist, Massachusetts General Hospital; Associate in Dermatology, Peter Bent Brigham Hospital; Consulting Dermatologist, Massachusetts Eye and Ear Infirmary. Cloth. Price, $10.00. Pp. 449, with 211 illustrations and 8 subjects in color on 4 plates. Philadelphia: J. B. Lippincott Company, 1949.

A concise compilation of dermatologic histo-

pathology is a welcome change from the usual textbooks of dermatology in which descriptions of pathologic changes must be located in a welter of other material and are usually of no great aid in diagnosis when found. In carrying out his purpose to keep his presentation brief and compact, the author has over-simplified complex problems which are all too obvious to the general pathologist. This gives an impression of scientific naivete which actually may be quite foreign to the author who is an experienced teacher. For both dermatologists and pathologists, a fuller treatment of the more difficult and controversial problems would be desirable. The author has profited by his training under excellent teachers of general pathology, but the completely satisfactory book in dermal histopathology must be written by a general pathologist who has had adequate experience in clinical dermatology. The author states that pathologists "usually are not too familiar with dermatologic diseases." Without raising the question as to how they could be *too* familiar, it is also true that most dermatologists have but little familiarity with general pathology.

The discussion of each entity is introduced by a few sentences giving clinical orientation. Then follows a brief characterization of the histopathology and a final paragraph on differential diagnosis. The significant features have been skillfully selected to be of maximum use to the student or diagnostician in identification of the clinical entity. It does not follow that these are the features which will be most helpful in explaining pathogenesis or in establishing a correlation with clinical signs and symptoms. These aspects of histopathology have been largely ignored in favor of diagnosis.

The many illustrations are an important part of this book and explain its comparatively high cost. They are all photographic and are remarkably free from artefacts of cutting. Most of the fields have been well selected, but the figures at low magnification (always more difficult to take) are often too dark and could not be interpreted by a beginner. The figures in color on the plates preceding the text lose much of their value by being separated from the text. There are three of them (granuloma annulare, histiocytoma, Kaposi's sarcoma) which are not sufficiently characteristic to be identified without the legends. There are other figures in black and white in respect to which the accuracy of the magnifications must be questioned. For instance, Figures 193 and 199 are both designated as × 200, but obviously Figure 193 was taken at a higher magnification than 199.

Good bibliographic lists follow each section. These are brought up to the year 1948. They are sufficient to direct the inquisitive student into controversial fields. The book is unusually free from typographical blemishes for a first edition. It can be strongly recommended to both pathologists and dermatologists who are in training and will be of use to the general pathologist as a reference compend of diagnostic features for those diseases which can be diagnosed from tissue sections.

A. James French, M.D.

Cancer of the Esophagus and Gastric Cardia. Edited by George T. Pack, B.S., M.D., New York, N. Y., Clinical Professor of Surgery, New York Medical College; Attending Surgeon, the Memorial Hospital for Cancer and Allied Diseases. Cloth. Price, $5.00. Pp. 192, with 25 illustrations. St. Louis: C. V. Mosby Company, 1949.

This book is a reprint of a symposium of the same title that appeared in the June, 1948, issue of *Surgery* with the addition of a historical sketch of the evolution of the operative techniques. Eighteen authors are listed in addition to the editor. Since the surgical attack on this area has in major part developed since 1940, the methods are still changing and improving with a constantly widening experience in the hands of many surgeons. Cancer in the cardia and esophagus is frequent and is susceptible to cure with earlier diagnosis and with radical surgical treatment. Aside from the Introduction and Summary by Pack, there are ten chapters written by surgeons of wide experience in the management of cancer in these regions. As they relate their views there is, of necessity, some duplication of matter but this probably adds to the readers' interest since many of the points involved are in flux, and light comes from controversy.

Preoperative preparation and postoperative handling are well covered. Diagnosis by roentgen ray, esophagoscopy and gastroscopy are detailed. Treatment by roentgen radiation according to Nielsen's methods is discussed and the results tabulated. The approaches devised by many surgeons are well described and their techniques for removal of various segments of the esophagus are well illustrated and explained. The treatment of these commonly oc-

curring cancers is now widely carried out by surgeons all over the world. Since few have had a wide experience this book will prove of value to anyone interested in participating in an aggressive therapy on cancer of the esophagus and upper end of the stomach and to those wishing to learn the possibilities of such treatment.

The book is pleasing to handle and to read. The illustrations are helpful and clear, the type and paper are satisfactory. Pack and his associate authors are to be congratulated on summarizing the present day knowledge in a stimulating way, well knowing that they only mark a milestone that will be passed through the further efforts of many striving in this comparatively new field of surgical endeavor.

Frederick A. Coller, M.D.

Clinical Radiation Therapy. By Ira I. Kaplan, M.D., F.A.C.R., Clinical Professor of Radiology, New York University Medical College; Attending Radiation Therapist, Beth-David Hospital, New York; Director, Radiation Therapy Department, Bellevue Hospital, New York. Second edition. Cloth. Price, $15.00. Pp. 844, with 614 illustrations. New York: Paul B. Hoeber, Inc., 1949.

This volume, which is much larger and more comprehensive than the first edition published twelve years ago, covers the therapeutic uses of roentgen rays generated at voltages not exceeding 200 kv. and radium. Sections dealing with radiation physics and the historical development of and the principles and general considerations involved in modern radiation therapy are followed by fourteen chapters, each devoted to the pathology of and therapy techniques advocated for all the lesions, both benign and malignant which may respond to irradiation in a single portion of the human body. Chapters on the treatment of inflammatory conditions, radiation complications and injuries, trauma and cancer and the legal aspects of radiation therapy are also included.

The material presented is based on a vast experience gained in a large hospital over a period of many years. Detailed techniques are given for the treatment of every condition listed and in many instances the results obtained in individual cases are illustrated by excellent photographs. Although little space is allotted to the methods used in other institutions, a rather extensive bibliography is made available to those who wish to study them.

The author is obviously vexed by the problem of biological dosage estimations as are all others who attempt to report work done over a long period of time. Many of his techniques are complicated by the use of more than one type of radiation and little consideration is given to the influence of the time factor.

Although most of the radium techniques are described so accurately that they can be duplicated, all doses are given in milligram-hours rather than in gamma roentgens delivered. To the radiotherapist interested in evaluating technical procedures, the most serious fault in this book consists of the complete absence of careful statistical studies on which comparisons can be based. However, experience is an excellent teacher and the beginner as well as the veteran radiologist will find many useful practical suggestions in this elaborate review of time tested plans of treatment.

Charles L. Martin, M.D.

Trattato di roentgen- e di curie-terapia. Edited by Felice Perussia and Enzo Pugno-Vanoni. Second edition, revised and enlarged. Cardboard. Price, L. 6000. Pp. 826, with 493 illustrations, and 4 color reproductions. Milano: Garzanti, 1947.

In the first volume of a monumental textbook of radiation therapy by the radiological school of Milan, E. Pugno-Vanoni, Gilardoni, and G. Pugno-Vanoni cover physics, technology, dosimetry, protection; Gallavresi and Bullo treat radiobiology, Ratti radiation damages. Therapeutic methods and techniques are described by Giongo for roentgen rays, and by Asti and Perussia for radium. Picchio completes the volume with a collection of 39 tables, and a survey of laws pertaining to radiation therapy.

The work takes up an enormous number of details, from laying out the floor plan of a radiation therapy department to treatments of patients after the course of radiation therapy. The presentation is very practical, and very detailed; conceivably too detailed, e.g., this reviewer cannot see the need for a four page table of products of milligrams by hours. In spite of its length the work is obviously not intended to be a reference work: the literature references are scarce (a 145 page chapter on radium techniques contains no reference to Paterson and Parker, etc.), some recent developments are treated in a rather general way. The great

value of the work lies in the fact that it gives a detailed account of procedures used by an outstanding group of radiologists.

H. Quastler, M.D.

Isotopic Tracers and Nuclear Radiations with Applications to Biology and Medicine. By William E. Siri. Contributions by Ellsworth C. Dougherty, Cornelius A. Tobias, Rayburn W. Dunn, James S. Robertson, and Patricia P. Weymouth—Division of Medical Physics, Department of Physics and Radiation Laboratory, University of California. Cloth. Price, $12.50 Pp. 653, with 136 illustrations and 49 tables. New York: McGraw-Hill Book Company, Inc., 1949.

This book represents, perhaps, the best effort to date, to gather within one volume information pertinent and useful to workers with isotopic tracers in the fields of biology and medicine.

It consists of three parts: the first concerning isotope and nuclear radiations; the second concerning methods and instruments, and the third dealing with biological and medical application of isotopes.

The first part is divided into seven chapters dealing with the properties of nuclear gamma rays, beta rays, protons, deuterons, alpha particles and neutrons. It covers, moreover, the mechanism of fission and of general radioactivity. The interactions of ionizing radiations with matter are described concisely and clearly. This section is generously interspersed with tables and formulae of definite interest and usefulness.

The second part consists of fifteen chapters which deal with the instruments generally available for the measurement of nuclear radiations and the procedures which are required in the standardization of radioactive samples in radioautography, internal dosimetry, and preparation of biological tissues for recovery of radioactive elements. Chapters on the safe handling of radioactive materials, the electrostatic generator, the cyclotron, the betatron and the synchrotron are included.

Part three, consisting of five chapters, begins with the general critique of biological applications of isotopes, and covers subsequently, the elements constituting major organic metabolites, major mineral metabolites, and tracer elements. Isotopes in therapy and diagnosis are discussed in Chapter 29 with particular emphasis on radiophosphorus, radioiodine, radiosodium and radiocolloids. The book closes with an extensive bibliography.

Since this book is encyclopedic in scope, many specialists will find it wanting in details concerning their field of interest. However, they and students in the tracer methodology, will find it invaluable as a ready source of reference and as an excellent starting point in the rapidly expanding literature on intermediary metabolism and medical physics.

L. D. Marinelli

Medical X-Ray Protection up to Two Million Volts. National Bureau of Standards Handbook 41. Issued March 30, 1949. (Supersedes Handbook 20.) Paper, Price, 15 cents. Pp. 49, with 6 line cuts and 9 tables. Washington: U. S. Government Printing Office, 1949.

The increasing use of high energy roentgen rays in medical diagnosis and treatment has presented new problems in all phases of radiation protection and shielding. Recommended standards of safety for the installation and use of high voltage roentgenologic equipment are concisely set forth in this new handbook, published by the National Bureau of Standards.

This handbook was written by a subcommittee of the National Committee on Radiation Protection composed of representatives of radiological societies, electrical societies, and the National Bureau of Standards. It contains instructions for meeting presently accepted standards as well as advisory recommendations that should be applied where possible. Rules are given for working conditions, survey and inspection of installations, planning an x-ray installation, structural details of protective barriers, and specific types of installations. A chapter on electrical protection treats such topics as high voltage circuits, grounding inspection and maintenance, warnings and instructions, and first aid and fire extinguishing devices. Also included are tables and graphs for determining the requirements of protective barriers and distance protection in specific cases.

This handbook is obtainable from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Remittances from foreign countries must be in U. S. exchange and must include an additional sum of one-third the publication price to cover mailing costs.

BOOKS RECEIVED

The Fundamentals of Pulmonary Tuberculosis and Its Complications. For the Student, the Teacher, and the Practicing Physician. Sponsored by the American College of Chest Physicians. Edited by Edward W. Hayes, M.D. Cloth. Price, $9.50. Pp. 480, with 182 illustrations and 2 full-page 4-color plates. Springfield, Illinois: Charles C Thomas 1949.

Le Diagnostic bio-clinique en Radiologie pulmonaire. By Georges Voluter, P. D. de Radiologie médicale à l'Université de Genève. Paper. Price, Swiss frs. 40. Pp. 452, with 100 illustrations. Basle: S. Karger Ltd., 1949.

Surface and Radiological Anatomy. For Students and General Practitioners. By A. B. Appleton, M.A., M.D. (Cantab.), Professor of Anatomy, University of London, etc.; W. J. Hamilton, M.D., D.Sc., F.R.S.E., Professor of Anatomy, University of London, etc.; and G. Simon, M.D., B. Ch., D.M.R.E. (Cantab.), Demonstrator of Radiological Anatomy, Medical College of St. Bartholomew's Hospital, etc. Third edition. Cloth. Price, $9.00. Pp. 332, with 390 illustrations. Baltimore: The Williams & Wilkins Company, 1949.

Roentgen Diagnosis of Diseases of the Skull. (Annals of Roentgenology, Volume XIX.) By Max Ritvo, M.D., Assistant Professor of Radiology, Harvard Medical School; Instructor in Radiology, Tufts Medical School, Boston, Massachusetts; Director, Department of Radiology, Boston City Hospital; Associate in Radiology, Beth Israel Hospital, Boston. Foreword by George W. Holmes, M.D. Cloth. Price, $16.00. Pp. 409, with 466 illustrations. New York: Paul B. Hoeber, Inc., 1949.

Neuroradiology. By Alexander Orley, M.D., F.F.R., D.M.R. &E., Hon. Consulting Radiologist, West End Hospital for Nervous Diseases, London. Cloth. Price, $11.50. Pp. 436, with 512 illustrations. Springfield, Illinois: Charles C Thomas, 1949.

The Arthropathies: A Handbook of Roentgen Diagnosis. By Alfred A. de Lorimier, M.D., Radiologist, Saint Francis Hospital, San Francisco; Consultant in Radiology for the United States Army at Letterman General Hospital; formerly Commandant, The Army School of Roentgenology. Second edition. Cloth. Price, $7.00. Pp. 335, with 157 illustrations. Chicago: The Year Book Publishers, Inc., 1949.

Roentgen Diagnosis of the Extremities and Spine. (Annals of Roentgenology, Volume XVII.) By Albert B. Ferguson, M.D., Associate Professor, Orthopaedic and Fracture Surgery, Boston University; Consulting Roentgenologist, Children's and Memorial Hospitals, Boston; formerly Director of Roentgenology, New York Orthopaedic Hospital. Second edition, revised and enlarged. Cloth. Price, $15.00. Pp. 519, with 633 illustrations. New York: Paul B. Hoeber, Inc., 1949.

Elementi di Anatomia Stratigrafica dello Scheletro. By Enzo Bullo, Aiuto e Docente dell'Istituto di Radiologia dell'Università di Milano; and Roberto D'Alò, Assistente Volontario dell'Istituto di Radiologia dell'-Universita di Milano. Cardboard. Price, L. 3500. Pp. 179, with 89 illustrations. Milano: Casa Editrice Ambrosiana, 1949.

Exploration Radiologique de l'Appareil Urinaire Inférieur. (Vessie-Urètre-Prostate.) By Bernard Fey, Fernand Stobbaerts, Pierre Truchot, and Georges Wolfromm, with the collaboration of Léonce Sabadini and others. Paper. Price, 2500 fr. Pp. 291, with 293 illustrations. Paris: Masson et Cie., 1949.

Die Pathologie des Harnleiters im Röntgenbild. By Privatdozent Dr. Anton Thelen. Paper. Price, $3.25. Pp. 87, with 71 illustrations. Stuttgart: Georg Thieme, 1949.

Grundlagen der Funktionellen Urologischen Röntgendiagnostik. By Dr. Med. Habil. Walter Pfeifer, Sandersbusch. Paper. Price, DM 9.60. Pp. 88, with 48 illustrations. Stuttgart: Georg Thieme, 1949.

Clinical Radiation Therapy. By Ira I. Kaplan, M.D., F.A.C.R., Clinical Professor of Radiology, New York University Medical College; Attending Radiation Therapist, Beth-David Hospital, New York; Director,

Radiation Therapy Department, Bellevue Hospital, New York. Second edition. Cloth. Price, $15.00. Pp. 844, with 614 illustrations New York: Paul B. Hoeber, Inc., 1949.

Aktuelle Probleme der Pathologie und Therapie. Herausgegeben von Prof. H. Holthusen, Hamburg. Cloth. Price, DM 29.00. Pp. 248, with 49 illustrations. Stuttgart: Georg Thieme, 1949.

Cancer of the Esophagus and Gastric Cardia. Edited by George T. Pack, B. S., M.D. New York, N.Y., Clinical Professor of Surgery, New York Medical College; Attending Surgeon, the Memorial Hospital for Cancer and Allied Diseases. Cloth. Price, $5.00. Pp. 192, with 25 illustrations. St. Louis: C. V. Mosby Company, 1949.

Malignant Disease and Its Treatment by Radium. By Sir Stanford Cade, K. B. E., C. B., F. R. C. S., M. R. C. P., Surgeon, Westminster Hospital, Mount Vernon Hospital and Radium Institute; Lecturer in Surgery, Westminster Hospital Medical School and formerly Examiner in Surgery; etc. Volume II. Second edition. Cloth. Price, $12.50. Pp. 430, with 366 illustrations. Baltimore: The Williams & Wilkins Company, 1949.

How to Become a Doctor. A Complete Guide to the Study of Medicine, Dentistry, Pharmacy, Veterinarian Medicine, Occupational Therapy, Chiropody and Foot Surgery, Optometry, Hospital Administration, Medical Illustration, and the Sciences. By George R. Moon, A. B., M. A., Examiner and Recorder, University of Illinois, Colleges of Medicine, Dentistry and Pharmacy. Cloth. Price, $2.00. Pp. 131. Philadelphia: The Blakiston Company, 1949.

Medical Photography—Radiographic and Clinical. By T. A. Longmore, Hon. F. S. R., Principal, Kodak School of Medical Radiography and Clinical Photography, Hon. Editor of "Radiography," Member of Council, Education Committee and Board of Examiners of the Society of Radiographers, etc. Fourth edition. Cloth. Price, 50/-net. Pp. 1,008, with 120 illustrations and 320 diagrams London. The Focal Press, 1949.

Pharmacology and Toxicology of Uranium Compounds. (With a Section on the Pharmacology and Toxicology of Fluorine and Hydrogen Fluoride.) Edited by Carl Voegtlin, Ph. D., formerly Chief of the Division of Pharmacology, National Institute of Health, U. S. Public Health Service; etc.; and Harold C. Hodge, Ph. D., Professor of Pharmacology and Toxicology, School of Medicine and Dentistry, University of Rochester. 2 parts. Cloth. Price, $10.00. Pp. 1,084, with numerous illustrations and tables. New York: McGraw-Hill Book Co. Inc., 1949.

Radiologia Austriaca. Herausgegeben von der Österreichischen Röntgen-Gesellschaft. Volume I. Cardboard. Price, $4.70. Pp. 130, with 82 illustrations. Wien: Urban & Schwarzenberg, 1948.

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ABSTRACTS OF RADIOLOGICAL LITERATURE

Department Editor: T. Leucutia, M. D., Harper Hospital, Detroit 1, Michigan

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ROENTGEN DIAGNOSIS

HEAD

van Waalwijk van Doorn, C., and Boet, J. N. Lacuna skull and craniofenestria. *Am. J. Dis. Child.*, March, 1949, *77*, 315–327.

Clinical and pathologic observations on several cases of fenestria seen within a few months in 1946 in Amsterdam, Netherlands, are reported in this paper. In lacuna skull and craniofenestria (Lückenschädel), there are congenital bony defects in the skull. In lacuna skull these defects are restricted to the diploe and the inner table. No abnormality may be seen in skull during life. Palpation reveals at the site of the defects a "springy" feeling, such as that in craniotabes (ping-ball phenomenon). Postmortem, the lacunas show up clearly with transmitted light. They appear to be bordered with strong, bony ridges, which give the entire interior of the skull the appearance of a network (reticulated skull).

Craniofenestria is a true bony defect. On palpation the defective areas are clearly felt. The cranial contents may protrude through these defects, a condition called multiple encephaloceles; the surface, in consequence, becomes knobby. In addition to the defective diploe and inner table, the outer table is absent also and therefore the dura is in contact with the periosteum. Again, the fenestria are surrounded with bony ridges and the edges are studded with fine, bony lamellas, giving the appearance of filigree work. The sutures of the skull are often irregularly toothed. In both anomalies the defects are usually localized to the parietal bones and are particularly common in the midline. They may also be observed in the frontal or occipital bone, in the alae magnae of the sphenoidal bone and in the squamous area of the temporal bone. They vary in size and number, and are not usually symmetric.

Lacuna skull and craniofenestria may be difficult to distinguish from each other and intermediate forms occur. They are often seen with spina bifida. The form of craniofenestria associated with herniation is usually combined with a myelomeningocele. A large percentage of such meningoceles lie in the thoracic portion of the spine. Other accompanying congenital anomalies reported in the literature are cleft palate, deformities of the ribs, clubfoot, bony defects of the humerus, absence of the radius and congenital cardiac anomalies.

Lacuna skull or craniofenestria should be thought of in all cases of spina bifida as well as in those of hydrocephalus and abnormalities of facial appearance, such as mongolism and other revealing characteristics as senile features, slanting eyes, broad zygoma and prognathism. The diagnosis according to some authors can be made only from a lateral roentgenogram.

The theories assumed to explain craniofenestria and lacuna skull fall into three groups. The first is the theory of increased intracranial pressure during intrauterine life. The second suggests a disorder of development. According to a third theory, craniofenestria is a result of other diseases; however, Wieland was able to exclude this possibility on histopathologic grounds. The authors lay emphasis on their opinion that the condition is caused by a developmental disturbance, which perhaps is due to malnutrition of the mother during pregnancy.—*R. S. Bromer, M.D.*

Hauser, Harry, and Elkins, Charles W. Intraventricular epidermoid. *Radiology*, Jan., 1949, *52*, 69–74.

A case of intraventricular epidermoid with characteristic pneumoencephalographic findings is reported. The authors state that only 6 such cases with these characteristic findings had previously been reported, theirs making the seventh. Their roentgen findings, considered characteristic, were described as a large oval-shaped mass surrounded by a layer of gas within the left lateral ventricle with streaky air shadows coursing through its substance. These irregularly shaped collections of gas with a streaky configuration are believed to be attributable to the infoldings of the wall of the epidermoid tumor lying in the ventricle. Other signs of brain tumor may be associated with the characteristic streaky shadows, such as displacement of the ventricular system and pineal body and internal hydrocephalus. Film reproductions are shown.—*D. S. Kellogg, M.D.*

Poppen, James L. Aid of arteriograms in diagnosis and treatment of intracranial aneurysms. *Radiology*, March, 1949, *52*, 347–352.

The responsibility of diagnosis and treatment of intracranial aneuryms falls heavily on the radiologist and neurosurgeon since the introduction of arteriograms by Egas Moniz in 1933. It is the duty of the radiologist to be well informed regarding the normal and anomalous anatomy of the circle of Willis and its branches.

He must also attempt to perfect himself in accurate descriptions of the exact relationship of the aneurysm to the openings or stomas of the larger branches of the circle of Willis.

In the writer's surgical series of 100 patients with intracranial aneurysms, only 9 were encountered in a period of ten years, while 101 were found in the past four years, chiefly because of an awareness that such a condition might be present.

Roentgenograms of the skull may be of great value in the larger aneurysms which have enlarged the sella turcica unilaterally, elevated one of the anterior clinoids or perhaps sharpened the latter by pressure from below. The thinning of the lateral margin of the optic foramen may also be of aid. Only the large aneurysms in direct contact with bone can possibly cause changes. Sosman has described the fine crescentic outlines or dense calcifications that may be found in aneurysms. The final diagnosis, therefore, rests on either the arteriogram or direct surgical exploration.

In the author's experience arteriography has allowed one to study the relationship of the aneurysm to the main branches of the circle of Willis. Since 75 per cent of intracranial aneurysms involve the anterior two-thirds of the circle of Willis, one should begin the investigation by visualization of that portion of the cerebral circulation.

The writer has completed well over 200 arteriograms, in most instances with thorotrast. More recently, however, diodrast has been employed with no untoward results.

The technique employed in making cerebral arteriograms is fully described.—*R. F. Niehaus, M.D.*

Marks, Joseph H., and Livingston, Kenneth E. The cervical subarachnoid space, with particular reference to syringomyelia and the Arnold-Chiari deformity. *Radiology*, Jan., 1949, *52*, 63–68.

The authors call attention to the fact that careful study of the cervical subarachnoid space, when injected with air or oxygen, may occasionally yield valuable information. While aware of the fact that 80 to 85 per cent of spinal cord tumors may be diagnosed by myelographic studies employing opaque media, they believe that an appreciable number may be demonstrated with air or oxygen, and thus these patients may not need to be subjected to the possible complications arising from residues of oil in the basal cisterns or elsewhere. They believe that the roentgen examination of all patients having encephalograms should include lateral stereoscopic films of sufficient size to show the cervical canal. Film reproductions on patients with syringomyelia and Arnold-Chiari deformity are included.—*D. S. Kellogg, M.D.*

Broman, Tore, and Olsson, Olle. Experimental study of contrast media for cerebral angiography with reference to possible injurious effects on the cerebral blood vessels. *Acta radiol.*, 1949, *31*, 321–334.

This investigation is concerned with the tolerance of the cerebral vessels to those contrast media of the diodrast type available in Sweden and recommended for cerebral angiography.

With the application times (maximum 40 seconds) used in the tests all the contrast media, except umbradil and umbradil-methylglucamine in 35 per cent solution, produced a lesion of the cerebral vessels. Compared with other contrast media of equal concentration umbradil forte proved but slightly injurious.

In all cases the injury consisted of a disorder of the vascular permeability recognized by a manifest impairment of the blood-brain barrier. In those cases in which the injury was rather marked, attendant stasis and punctate hemorrhages were also observed, i.e., the injury sustained was of a serious nature.

As certain 'indifferent" substances (NaCl, glucose) evidently required a higher osmotic pressure to produce a manifest injury, the cerebral lesions observed could not be attributed solely to an osmotic action but must have been the result of a chemotoxic effect.—*Mary Frances Vastine, M.D.*

Carpendale, M. T. F. Lymphosarcoma presenting as edema of the eyelids. *Lancet*, Feb. 19, 1949, *1*, 305–306.

Secondary involvement of skin in cases of lymphosarcoma is not uncommon. Its frequency has been noted as high as 22 per cent. However, lymphosarcoma presenting primarily as a skin lesion is very rare. The present report concerns a single case which gave the appearance of an edema of the left eyelid. It closely resembled a type of recurrent facial cellulitis. It was originally diagnosed as being secondary to ethmoiditis though there was no obvious infec-

tion in the nose or sinuses. Later, it resembled a recurrent erysipelatoid lesion. Another possible diagnosis was angioneurotic edema. Another is mycosis fungoides which may in certain forms resemble the present lesion as seen at biopsy. Up to the time of the biopsy, the clinical picture of the present case was much less like that of a sarcoma than that of a cutaneous inflammation. The patient later developed a generalized lymphosarcomatosis, and died approximately three months after she was first seen.— *J. S. Summers, M.D.*

Fleischner, F. G., and Shalek, S. R. Conjunctival and corneal calcification in hypercalcemia. *New England J. Med.*, Dec., 1, 1949, *241*, 863–865.

Calcification of the conjunctiva and cornea in patients with hypercalcemia from hyperparathyroidism or vitamin D poisoning has previously been noted. The conjunctival lesions are minute, isolated, crystal-clear particles in the interpalpebral space. The corneal lesions are granular opacities on the nasal or temporal side, or both, close to the limbus. Conjunctival biopsy suggests that the deposits are calcium phosphate.

The authors describe the roentgenographic visualization and appearance of conjunctival and corneal calcifications in a male, aged forty-two, with hypercalcemia associated with severe advanced chronic rheumatoid polyarthritis, marked generalized decalcification of bone, urinary calculi, and nephrocalcinosis. Films of the skull showed faint annular intraorbital calcification. Tangential views of the anterior convexity of the globe, using a dental roentgen machine and dental film, allowed identification and study of both conjunctival and corneal calcifications. In tangential view, the conjunctival calcifications appeared as blunt, rod-like, calcific deposits, 2 mm. in width and 3 or 4 mm. in length, in curvilinear arrangement. The corneal calcification existed as a dense, continuous, calcific shadow less than 1 mm. in width and 7 or 8 mm. in length. A technique for demonstration of such calcifications is described.— *Henry P. Brean, M. D.*

Ingraham, F. D., Alexander, Eben, and Matson, D. D. Clinical studies in craniosynostosis. *Surgery*, Sept., 1948, *24*, 518–541.

This report is based on 50 cases of craniosynostosis which are discussed under four main groups. Although the bony deformities are important, the resultant mental retardation of untreated patients is more serious and surgical intervention in the first few months of life is stressed. Premature closure of cranial sutures restricts the growth of the brain. This must be differentiated from microcephaly in which the primary difficulty is failure of the brain to grow. The commonest group is that of premature closure of the sagittal suture. Other congenital anomalies are common although ocular difficulties are rare. The contour of the head of the scaphocephalic patient operated on in the first few weeks of life shows a striking change. As midline sagittal craniectomy may damage the longitudinal sinus, the authors used bilateral parasagittal craniectomies.

The second group included cases of premature closure of the coronal suture. The incidence of congenital anomalies is high. Surgical treatment consisted of coronal craniectomy in this series.

In the third group patients exhibiting premature closure of the sagittal and coronal and the sagittal and lambdoidal sutures are discussed. Since growth is axial to the closed suture each is represented by a different cranial contour. Other anomalies were frequent in the latter group.

The fourth group is composed of those patients with premature closure of all cranial sutures. The deformity depends on the sequence of the closures. Previous reports indicate that blindness as well as mental deficiency is common. Optic impairment is probably associated with chronically increased intracranial pressure. Patients in this series with optic difficulties all showed accentuated digital markings.

There are other types of synostosis cranii such as closure of only one side of the coronal suture. Mild deformities do not interfere with normal brain growth. One type of deformity results from closure of the metopic suture in utero which is normally obliterated at birth.

Surgical treatment has consisted of linear craniectomies and various decompressions. Linear craniectomy in the region of the fused sutures is considered the most physiologic method. The rapid rate of bone regeneration frequently results in early reclosure. Thus, the present technique incorporates polythene film with which both edges are wrapped. Wide removal of the pericranium is also recommended. In 44 of the 50 cases surgical methods of treatment were used.

Mental, physical and roentgenologic examinations must be made periodically because gradual premature closure of other sutures may develop. The prognosis for mental development of patients treated within the first year of life is generally good and operative mortality is negligible.—*C. B. Holman, M.D.*

Smithan, J. Hillyer. Some observations on certain congenital abnormalities of the hand in African natives. *Brit. J. Radiol.*, Oct., 1948, *21*, 513–518.

During routine examination of natives in the Gold Coast of Africa, it was noted that fusion of the lunate and triquetrum and fusion of the hamate and capitate occurred more frequently than expected. For this reason, 680 men, women and children were examined.

Fusion of the lunate and triquetrum was found in almost 6 per cent of the individuals. It is usually bilateral, and when unilateral is always in the right wrist. Fusion of the hamate and capitate occurred in 0.73 per cent and was always bilateral.

A discussion of the abnormality includes the embryology and comparative anatomy. It is felt that this abnormality, rather than indicating further specialization and simplification, represents an evolutionary experiment which has not persisted.—*E. F. Lang, M.D.*

Bull, J. W. D. The diagnosis of chronic subdural hematoma in children and adolescents. *Brit. J. Radiol.*, Feb. 1949, *22*, 68–80.

In adults frequently subdural hematoma cannot be diagnosed clinically. Frequently cerebral pneumography can establish the diagnosis, but often the preoperative diagnosis can be made only by angiography. In growing children, when the changes are present long enough, alterations in the skull may permit a diagnosis without the use of contrast media.

In some children the plain roentgenograms of the skull show no abnormality. In these cases, ventriculography usually shows: (1) dilated contralateral ventricle with a high lateral roof; (2) normal sized homolateral ventricle with a flattened roof; (3) shifted but vertical septum pellucidum; (4) only the upper part of the third ventricle shifted with septum pellucidum; (5) normal contralateral temporal horn; (6) medial shift of homolateral temporal horn.

The largest group of patients showed pathognomonic changes in the plain roentgenograms of the skull. In the frontal view there is seen elevation of the lesser sphenoid wing. In a submentovertical view, forward and outward bulging of the greater sphenoid wing is to be seen. Dyke and Davidoff have described, in addition, atrophy of the superior and lateral wall of the superior orbital fissure, hypertrophy of the frontal and ethmoidal sinuses on the affected side, and thickening of the skull; but the author has not been able to confirm these findings. In one of these patients changes in the growth of the skull were observed three months following an injury. A previous report by Hardman describes bulging of the middle fossa ten weeks after the injury.

A third small group of cases presented calcification in the subdural collection of blood. In addition to this, some of this group showed hemiatrophy on the side of the lesion involving both the skull and, as shown by encephalography, the brain.—*E. F. Lang, M.D.*

Revilla, Antonio Gonzalez. Differential diagnosis of tumors at the cerebellopontine recess. Bull. Johns Hopkins Hosp., Sept., 1948, *83*, 187–212.

An analysis of 205 tumors occupying the cerebellopontile recess verified by operation was given. The main differential diagnostic features were stressed. The salient features are:

1. Neurinoma: These comprised 78 per cent (160 cases) of the total. Of these the unilateral acoustic neurimona accounted for 145 cases. The incidence was greater in females. The average age at onset of symptoms was 39.6 years and the average duration of symptoms was 4.5 years. Involvement of the VIIIth N. was present in all cases. The Vth N. and the cerebellar pathways were also often involved. Papilledema was found in 66.5 per cent. Roentgen evidence of destruction of the porus acusticus was present in 50 per cent There were 3 cases (1.5 per cent) of unilateral acoustic neurinomas and peripheral neurofibromatosis with the average age at onset of symptoms being 14.3 years and the average duration of symptoms ten years. Six cases (3 per cent) of bilateral acoustic neurinomas were encountered. In these the average age at onset of symptoms was 17.8 years and the duration of symptoms five years. Roentgenograms showed erosion of the porus acusticus. Neurinomas of the Vth, Xth and XIth nerves accounted for the remaining 6 cases.

2. Cholesteatomas: These comprised 6.3 per cent (13 cases) of the total. Females were more

often affected than males. The average age at onset of symptoms was 33.3 years and the average duration of symptoms was 7.3 years. The left side was almost invariably involved. Ten cases showed the symptom of tic douloureux whereas 3 had VIIIth N. involvement. Headaches were rare and papilledema was very rare

Of the roentgenograms taken only one showed erosion of the porus acusticus.

3. Meningiomas: These comprised 6.3 per cent (13 cases) of the total. Females were affected more often than males. The average age at onset of symptoms was 46.3 years and the average duration of symptoms was four years. The right side was almost invariably involved. The Vth, VIIth, and VIIIth nerves were commonly involved. Headaches were common. Papilledema and cerebellar signs were frequent. Roentgenograms showed destruction of the petrous pyramid in 1 case and enlargement of the sella turcica in 2 cases.

4. Gliomas: These comprised 5.9 per cent (12 cases) of the total. Of these, 2.4 per cent(5 cases) were astrocytomas. Females comprised all of the group. The average age at onset of symptoms was 26.3 years and the average duration of symptoms was 3.1 years. The VIIIth N. was commonly involved and all cases had VIIth N. paralysis. Roentgenograms showed no changes in the porus acusticus. There was 1 case (0.5 per cent) of astroblastoma. A case report of this was given. Medulloblastomas comprised 1.5 per cent (3 cases). The average age at onset of symptoms was 28.1 years and the duration of symptoms was 2.5 years. Vth N., VIIIth N., and cerebellar involvement was present in all. Papilledema was absent. Roentgen studies were negative in all. Two cases (0.9 per cent) were ependymonas. The average age at onset of symptoms was forty years with a duration of 2.5 years. One case (0.5 per cent) of glioblastoma multiforme was found. A case report was given.

5. Abscesses: These comprised 2 per cent (4 cases) of the total. The average age at onset of symptoms was 16.1 years. Primary pyogenic foci were present in all and fever and leucocytosis was a common feature. Roentgenograms were uniformly negative.

6. Miscellaneous tumors: These comprised 3 cases (1.5 per cent). One sarcoma of the meninges, one carotid body tumor and one malignant melanoma. A case report of each was given.

It was concluded that the age at onset and duration of symptoms are the most important points in the differential diagnosis of tumors of the cerebellopontile recess. There is no specificity in chronology of symptoms. When roentgenograms show erosion of the porus acusticus, an acoustic neurinoma is most likely present.—*Jerome J. Wiesner, M.D.*

Lima, Almeida. Aspectos angiográficos e algumas perspectivas terapêuticas da trombose das artérias carótidas e outras obstruções dos vasos intracranianos. (Angiographic aspects and some therapeutic considerations regarding thrombosis of the carotid arteries and other obstructions of the intracranial vessels.) *Brasil méd.-cir.*, June–July, 1948, *10*, 353–370.

Cerebral angiography has been found especially valuable in the diagnosis and preoperative evaluation of (1) hemiplegia resulting from obstruction of the internal carotid in the neck region (Moniz' syndrome), (2) selected cases of cerebral occlusion regardless of etiology, (3) cerebral localization of Buerger's disease, (4) post-traumatic syndromes with relation of the focal brain lesion to local vasospasms, and (5) certain forms of epilepsy with, at least, one vascular component.

Typical angiographic findings for carotid thrombosis are described as follows: unusually good vascular pattern of the unaffected side, frequent widening and tortuosity of the carotid artery, practically constant duplication of the anterior cerebral and pericallous arteries and inconstant duplication of the sylvian arteries of the affected side. In addition to unilateral thrombosis of the carotid artery, bilateral thrombosis of the internal carotid arteries (syphilitic and arteriosclerotic), obliteration of the common carotid artery, thrombosis of the external carotid and of the intracranial arteries as well as thrombosis of the venous sinuses are discussed. In the latter case the roentgenogram revealed signs of a fracture of the internal table at the level corresponding to the venous obliteration. Special emphasis is placed on the operative procedures indicated in the different lesions as revealed by roentgenologic and clinical study.—*E. A. Schmidt, M.D.*

Mayerszky, Clara. Platybasia; with case report. *J. Neurol., Neurosurg. & Psychiat.*, Feb., 1949, *12*, 61–65.

From both pathological-anatomical and clinical aspects, the condition called impressio

basilaris cranii, "basilar impression," or "basilar invagination" was well known in the last century. In the last fifteen years, it is referred to more often as "platybasia," in which the "basal angle" (the angle between the lines through the sphenoidal planum and clivus) is increased beyond the normal 135–140 degrees.

Rokitansky (1846) is usually recorded as having first described it without any specific name but Berg and Retzius (1855) described it under the name impressio baseas crani. As Chamberlain (1939) had described 4 cases of platybasia, 2 of which had been successfully operated on by Temple Fay, it attracted attention in America. According to the present-day opinion, basilar impressions may be primary or secondary. Primary basilar impression may be the result of a defect in the craniovertebral development arising, according to Virchow's and Grawitz's suggestions, from the early ossification of the spheno-occipital suture, a defect in chondrogenesis and ossification. The posterior fossa fails to keep up in developmental pace with the vertebrae; the atlas overgrows the foramen magnum and does not join the condyles but fuses with the posterior rim of the foramen magnum.

Secondary basilar impression may occur in any disease causing softening of the bones (Paget's disease, rickets, osteomalacia, hyperparathyroidism, lipoidosis, caries, senile osteoporosis, etc.).

In the symptomatology, there are some skeletal signs which provoke no particular complaints, such as the striking short neck, a certain restriction in the movement of the head, the low hairline at the base of the neck. These signs may increase in time but not necessarily. The basilar impression may assume clinical importance by causing neurological signs of direct compression on the pons and medulla oblongata.

The roentgen investigation of the skull establishes the diagnosis. On the roentgenograms in the lateral view, the basal angle is increased to more than 140° (though some authors allow 150° as normal), the clivus approaches the horizontal line in different degrees; the shadows of the atlas and the odontoid process are above the so-called Chamberlain's line (the line between the posterior rim of the foramen magnum and the posterior edge of the hard palate), though normally they are below it. The foramen magnum is usually pressed upwards into the posterior fossa, and is narrowed, eccentric and abnormal in shape. Encephalography usually shows a varying degree of dilatation of the ventricles. In the differential diagnosis, cervical syringomyelia, chronic hydrocephalus, cerebellar tumor, bulbar encephalitis, angle tumor must be considered.

Treatment may be exclusively surgical. This, however, has been practiced only in the last fifteen years. The surgical treatment consists essentially of upper cervical laminectomy with suboccipital decompression.

A case of secondary platybasia of rachitic origin is described which was relieved by upper cervical laminectomy.— *Juliam I. Gilliam, M.D.*

NECK AND CHEST

McSwain, Barton, and Diveley, W. Malignant tumors of the thyroid gland. *Surgery*, March, 1948, *23*, 525–541.

The authors found 23 patients with malignant disease of the thyroid gland over a period of twenty-two years among 122,633 admissions to the Vanderbilt University Hospital. Their recapitulation of data from other large clinics shows that these lesions are uncommon outside the "goitre belt."

Their classification includes the following, the first four categories gradually merging from one histopathologic type to another: (1) papillary adenocarcinoma, (2) adenocarcinoma, (3) alveolar adenocarcinoma, (4) alveolar carcinoma, (5) giant cell carcinoma, (6) squamous cell carcinoma and (7) sarcoma. The Hürthle cell carcinomas are grouped with the alveolar adenocarcinomas. The authors present reasons for discarding the terms "small cell carcinoma," "scirrhous" and "malignant adenoma." The so-called lateral aberrant thyroid is usually considered to be metastasis to lymphoid tissue, and necessitates exploration of the gland. The diagnosis of malignant disease is based on cytologic criteria rather than on invasion of blood vessels which may be difficult to prove.

The chief complaints of 9 patients who lived four to eighteen years after diagnosis were: increase in size of a goiter and symptoms of pressure. Rupture of a cervical mass, symptoms of hyperthyroidism, loss of weight and sleepiness with subsequent enlargement of a cervical node, also were noted. Seven of these patients had had goiters from four to thirty years. Enlargement of the thyroid gland, rather than duration of the goiter, is important in prognosis. One patient showed evidence of hypothyroidism.

Hard, firm and soft tumors were found. In 7 cases tumors were thought to have arisen from adenomas.

Nine of 20 patients operated on are alive and in only 3 cases was complete removal done. Roentgen therapy was not used in these 3 cases. The authors state that if it is thought from examination of the gross specimen and microscopic sections that all the tumor was removed, irradiation should not be used. They believe recurrent nodules should be removed.

Roentgenologic factors employed were 200 kv., 20 ma., distance of 50 cm., 0.5 mm. copper and 1.0 mm. aluminum filtration; 400 r per field per day, 2 fields irradiated. The total dose approximated 2,800 r. One patient is alive and without recurrence eight years after biopsy and roentgen therapy.—*C. B. Holman, M.D.*

Hilbish, Theodore F. Role of the roentgenologist in a proposed plan for small film screening of the inhabitants of major cities. *Radiology*, Feb., 1949, *52*, 248–251.

In the proposed small film survey of 30,000,000 inhabitants over the age of fifteen in 92 cities with populations over 100,000, roentgenologists should:

(1) Help assure expert interpretation of the small films used in the screening survey.

(2) Help supervise the diagnosis and follow-up of active and inactive cases of tuberculosis discovered in the survey.

(3) Through their personal prestige and organized societies exert a powerful influence to aid in the nation's fight against tuberculosis.

The survey in any community is initiated locally, usually with the technical help of the local medical society. To be effective, the entire major city survey should be completed in five years or less.

In the discussion Dr. Sante points out the economic problems of proper care for the cases detected,—and of the necessity for repeating the surveys.—*Henry G. Moehring, M.D.*

Anderson, W. A. D. Pathological aspects of atypical pneumonias (interstitial pneumonitis). *Dis. of Chest*, March, 1949, *15*, 337–345.

The author presents aspects of underlying pathological changes in common and unusual types of atypical or interstitial pneumonias. The inflammatory reaction and exudates are found predominantly in the interstitial tissues or supporting bronchial tree rather than in the alveolar spaces. In general, this interstitial reaction is a reaction to injury by microorganisms living intracellularly—viruses, rickettsiae, toxoplasma, and histoplasma. Higher bacteria rarely cause the interstitial reaction.

Influenzal pneumonia was of the interstitial type during the pandemic of influenza in 1918 if the patient died in five days; secondary bacterial infection caused lobar or bronchopneumonias if the cases survived more than one week.

Acute interstitial pneumonitis, etiology undetermined, or atypical pneumonia is probably of virus origin. A few rare postmortem cases have shown interstitial infiltration as well as metaplasia of lining epithelial cells. Psittacosis gives an identical pathological picture.

Several rickettsial diseases, including Q fever and scrub typhus show similar interstitial pneumonitis. Toxoplasma, a protozoan, has caused identical findings. In addition, one case of histoplasmosis, of fungus origin, showed interstitial pneumonitis with fibrosis and blood vessel involvement.

"Inclusion disease" of Farber and Wolbach is an interstitial pneumonia of infancy with prominent alveolar lining cells, and occasional granular inclusions distending the nuclei.

Finally, acute diffuse interstitial fibrosis of the lungs shows thickened alveolar walls with progressive fibrosis leading to cyanosis, and eventual right-sided heart failure. There is little cellular exudate in comparison with interstitial pneumonitis.—*Frederick R. Gilmore, M.D.*

Marks, Jerome L., and Nathan, Alvin. The linear atelectatic sign in intra-abdominal lesions. *Radiology*, March, 1949, *52*, 363–366.

A total of 9,487 chest roentgenograms were utilized in the series of cases reported. In 29 of this number linear atelectasis was demonstrated. In 3 no cause could be found for the changes. Of the 26 remaining cases, 22 were proved to be secondary to an intra-abdominal lesion with elevated diaphragm. The other 4 cases were due to chest lesions.

The authors emphasize the importance of linear atelectasis as a presumptive sign of a lesion within the abdomen.—*Vernon L. Peterson, M.D.*

Reisner, David. Incipiency and evolution of pulmonary tuberculosis. I. The initial manifestations of the disease. *Am. Rev. Tuberc.*, March, 1948, *57*, 207–228.

The study of incipient tuberculosis in 344 apparently healthy persons examined in the course of routine periodic chest roentgenograms is reported. In 90 per cent of cases contact history was the sole reason for admission to the Clinic. Only cases with available previous negative roentgenograms were included in this group, thus justifying the use of the term "incipient."

The material is presented statistically and discussed according to age, sex, race, stage of disease, location of lesion, character of roentgenographic changes with illustrative examples; and associated symptoms.—*Lois C. Collins, M.D.*

Reisner, David. Incipiency and evolution of pulmonary tuberculosis. II. The behavior of the initial lesion and course of the disease during observation period. *Am. Rev. Tuberc.*, March, 1948, *57*, 229–253.

The follow-up studies on the material presented in Part I are reported, with particular emphasis on the behavior of the early lesion of minimal extent. The average observation period amounted to three and a half years.

The observations indicated that the incipient lesion of minimal extent is practically always unstable, and exhibits a great tendency to progressive disease, particularly in non-white patients. There were no criteria for predetermining the risk of progression of disease. Observation of the behavior of the lesion over a considerable period of time (several years) is essential.—*Lois C. Collins, M.D.*

Castex, Mariano R., Capdehourat, Eduardo L., and Mazzei, Egidio S. El factor bronquial en los cardíacos negros de ayerza. (The bronchial factor in cardiac cyanotics of ayerza's disease.) *Brasil médcir.*, March, 1948, *10*, 139–150.

Roentgenographic examinations, supplemented by bronchography, present the typical picture of increased translucency of the lung fields, widening of the intercostal spaces, marked descent of the diaphragmatic domes with limitation of the diaphragmatic excursion, indicative of emphysema in consequence of chronic bronchitis. Bronchographically, a certain degree of bronchial dilatation is manifest which in older cases occasionally reaches the extent of real bronchiectasis. The inflammatory bronchial changes and their sequelae interfere seriously with the alveolar ventilation both in inspiration and expiration and explain the hypoxemia, hypercapnemia and other abnormal changes observed in this disease.—*Ernst Schmidt, M.D.*

Koven, A. Link. Bagassosis. *Am. Rev. Tuberc.*, July, 1948, *58*, 55–63.

It is not known whether the disease is due to some chemical or physical property of dust of dried sugar cane, to its property as an allergen, to associated fungi or bacteria, or to a combination of these factors. The history, physical signs, and roentgen findings are tabulated for 11 cases, but no roentgenograms are reproduced.—*Vincent P. Collins, M.D.*

Hardy, Harriett L. Delayed chemical pneumonitis in workers exposed to beryllium compounds. *Am. Rev. Tuberc.*, June, 1948, *57*, 547–556.

Instances of delayed chemical pneumonitis, in addition to the acute chemical pneumonitis previously recognized, have been appearing among workers exposed to beryllium compounds. The material presented is based upon the records of 36 patients out of 1,400 workers engaged in the manufacture of fluorescent lamps who were thought to be similarly exposed. The exposure period ranged from eight months to eight years. In 20 out of 32 cases the onset of symptoms was from one month to four years after the last known exposure. The symptoms of onset were weight loss, dypsnea, anorexia, cough, weakness and fatigue. The pathology is described as a diffuse pulmonary granulomatosis. The chief diseases to be excluded are tuberculosis, silicosis and sarcoidosis. Three instances of apparent delayed chemical pneumonitis occurred in individuals who were not workers in the industry. Two of these lived in the immediate vicinity of a building where fluorescent powders were handled. One was the mother of a worker daughter who died of delayed chemical poisoning after an illness of two years.

It has not been established that the metal beryllium is, of itself, harmful although lung and bone lesions have been produced in animals by the administration of beryllium compounds. The evidence incriminating beryllium rests solely on its presence as the common denominator in the working environment of these patients who present various types of pulmonary disability.—*Vincent P. Collins, M.D.*

Pirani, Conrad L., Ewart, Fred E., and Wilson, Audrey L. Thromboendarteritis with multiple mycotic aneurysms of branches of the pulmonary artery. *Am. J. Dis. Child.*, April, 1949, *77*, 460–473.

The authors report a case of thromboendarteritis of the pulmonary arteries with multiple mycotic aneurysms within the lungs. Such a condition is extremely rare, occurring more frequently on the basis of bacterial endocarditis and only exceptionally on the basis of thrombophlebitis, as in the case reported.

The patient was a boy of ten years of age. On the first roentgen examination there were increased bronchovascular markings in the lungs but no parenchymal changes. On the second, approximately six weeks later, enlarged hilar nodes were found, with conspicuous accentuation of bronchovascular markings. Small irregular areas of density extended into the parenchyma of both pulmonary lung fields. On the third examination after approximately the same interval many round areas of density were shown in the hilar regions, extending into the parenchyma. The edges of the areas of density were not discrete but blurred.

The clinical and roentgenologic findings in this condition are not characteristic and cases in which the diagnosis was made in life have not been reported. Such a diagnosis, the authors believe, should be thought of in cases of bacterial endocarditis and chronic thrombophlebitis when pulmonary symptoms, such as hemoptysis, associated with atypical pulmonary shadows in the roentgenograms of the chest are observed.—*R. S. Bromer, M.D.*

Woolner, Lewis B., and McDonald, John R. Carcinoma cells in sputum and bronchial secretions; study of 150 consecutive cases in which results were positive. *Surg., Gynec. & Obst.*, March, 1949, *88*, 273–290.

The purpose of this study was the identification of cancer cells in sputum or bronchial secretions and evaluation of the smear technique as a routine procedure in the diagnosis of bronchogenic carcinoma. The technique employed was based on the original work of Dudgeon and Wrigley.

1. Smears of sputum or bronchial secretions from non-neoplastic diseases of the lung revealed squamous and ciliated columnar epithelial cells, macrophages, and various inflammatory cells.

2. Carcinoma cells in smears could be distinguished from normal cells by numerous atypical characteristics including large size, variation in size and shape of the cells and of the nucleus, the nuclear-cytoplasmic ratio, hyperchromatism of the nucleus, and the presence of large nucleoli.

3. The appearance of carcinoma cells in sputum and bronchial secretions varies with the histopathologic type of tumor in the bronchus. Cancer cells originating in a bronchogenic carcinoma of small cell "oat-cell" type or in a keratinizing squamous cell type provide the most distinctive morphologic characteristics. A diagnosis of the histopathologic type of tumor present was usually possible in the case of these two cell types. In most other bronchogenic carcinomas, especially the more undifferentiated tumors, a diagnosis of "carcinoma cells present" was made without reference to histopathologic type.

4. Metastatic lesions of the lungs may be the source of carcinoma cells in sputum or bronchial secretions.

5. Analysis of 150 cases in which the smears were diagnosed positive for carcinoma cells was carried out. In 146 of these cases the source of the atypical cells was believed to be a tumor in the bronchial tree. In 141 of the 146 cases a final diagnosis of primary or metastatic carcinoma of the lung was made. In 3 cases diagnoses made on the basis of smears were proved to be false positives. In 2 cases the final diagnosis, whether inflammatory or neoplastic, was not definitely established.

6. Carcinoma cells in sputum or bronchial secretions provided the only preoperative microscopic evidence of cancer in 25 cases (43 per cent) of a total of 58 cases in this series in which surgical exploration was carried out.

7. Of 24 cases of bronchogenic carcinoma in which the lesion could be removed, cancer cells in the smears provided the only microscopic evidence of cancer in 9 cases (37 per cent).—*Mary Frances Vastine, M.D.*

Lodmell, Elmer A., and Capps, Samuel C. Spontaneous pneumothorax associated with metastatic sarcoma. *Radiology*, Jan., 1949, *52*, 88–93.

The authors state that the occurrence of spontaneous pneumothorax with metastatic tumors in the lung has rarely been reported. They describe 3 cases which they encountered over a relatively short period, and mention a fourth in the "Addendum" at the end of their

article. The metastatic lesions were fibrosarcoma, primary in the neck; osteogenic sarcoma, primary in the tibia; angiosarcoma, primary in the retroperitoneal space; and another osteogenic sarcoma, primary in the femur. In the first 3 the pneumothorax was bilateral. The patients appear to tolerate the pneumothorax well until shortly before death. The probable mechanics contributing to the occurrence of pneumothorax with these metastatic lesions is discussed.—*D. S. Kellogg, M.D.*

Heald, F., and Wilder, T. S. Pneumomediastinum in the newborn infant. *J. Pediat.*, March, 1949, *34*, 325–330.

Pneumomediastinum is one of the causes of cyanosis of the newborn. Only 20 cases have been reported. The authors report the 21st case.

Their patient was one day old on admission at which time he was cyanotic, comatose and barely breathing. The delivery had been uneventful. Cyanosis had developed twelve hours following birth and had progressed rapidly. The heart could not be outlined by percussion. The cyanosis was relieved by oxygen administration. A roentgenogram of the chest showed atelectasis of the right lower lobe and on a lateral film air was demonstrable in the anterior mediastinum. Needle aspiration of the anterior mediastinum resulted in progressive relief of symptoms.

Macklin originally demonstrated the mechanics of pneumomediastinum in experimental animals. He proved it to be the result of emphysema which produces overdistention of the alveoli. Air subsequently escapes into the pulmonary vascular sheath through minute ruptures in the alveoli. The air dissects its way to the lung hila and subsequently into the mediastinum.

The end result of pneumomediastinum may be death or decompression by one of the following three routes:

1. Escape of air into the retroperitoneal space and even into the groin and leg.

2. Escape of air into the axilla, chest wall, root of neck, and face.

3. Escape of air into the parietal pleura and pericardium. The latter method occurred in the authors' case and caused the alarming clinical symptoms by exerting pressure over the large veins to the heart, decreasing venous return and producing circulatory embarrassment.

Pressure can be relieved by needle aspiration or by rupture of the mediastinal space into the pleura causing pneumothorax.

Illustrative films are reproduced.—*Rolfe M. Harvey, M.D.*

Lobman, A. J. M. Mediastinitis anterior chronica. *Acta med. Scandinav.*, July, 1948, *131*, 51–65.

Five cases of precordial complaints are described in which a chronic inflammation of the mediastinum (anterior) with an extensive adhesive formation of the visceral pericardium at the back of the sternum and xyphoid must be considered as the cause of the complaints. The origin is probably connected with a preceding acute tracheobronchitis or pharyngitis. The infecting organism was thought to be a streptococcus or influenza bacillus. The retrograde transport of the organism along the lymph nodes and lymph vessels of the anterior mediastinum is considered the most likely mode of infection. Surgical intervention is the treatment of choice for some cases. One patient was treated by resection of the lower part of the sternum and the xiphoid process. In roentgen diagnosis a lateral film of the chest is of great value. Tomography and kymography may be of value at times.—*Charles Nice, M.D.*

Cooley, Robert N., Bahnson, Henry T., and Hanlon, C. Rollins. Angiocardiography in congenital heart disease of cyanotic type with pulmonic stenosis or atresia. *Radiology*, March, 1949, *52*, 329–346.

The writers present an excellent summary of their fine article on angiocardiography in congenital heart disease. It is quoted in full:

"With the advent of surgical therapy for congenital heart disease of the cyanotic type, the necessity for exact diagnosis has become more important.

"Angiocardiography is a valuable technic in establishing an accurate diagnosis, when employed in conjunction with clinical, laboratory, and physiological studies, such as catheterization of the heart.

"The authors have used this technic in 75 patients with congenital cyanotic heart disease; 140 injections have been made without serious reaction.

"Nine patients have been selected for detailed consideration in order to emphasize the advantages and shortcomings of the method in preoperative evaluation.

"Seven patients had the tetralogy of Fallot

and two had a truncus arteriosus. All were subjected to operation, and in one instance postmortem studies were available.

"An overriding aorta could be demonstrated in all instances, as well as the position of the descending aorta.

"An interventricular septal defect may sometimes be directly demonstrated.

"Direct visualization of the pulmonary conus is so difficult as to be untrustworthy, but strong presumptive evidence of stenosis may often be obtained. It is not possible by angiocardiography alone to distinguish pulmonary atresia from a high degree of stenosis.

The presence and character of the pulmonary arteries may be reliably determined. Failure to demonstrate the proximal portions of the pulmonary artery, however, does not rule out the possibility of a successful anastomosis."—*R. F. Niehaus, M.D.*

Lubschitz, Karen, Lundsteen, Erling, and Forchhammer, Eva. Primary malignant heart tumor diagnosed in vivo with the aid of artificial pneumopericardium. *Radiology*, Jan., 1949, *52*, 79–87.

Primary heart tumors are rare, and their antemortem diagnosis is still more rare. The authors state that only 163 primary heart tumors had been reported in the literature up to 1945, and that only 12 of these had been diagnosed antemortem. Their case, the thirteenth, is reported in detail, the microscopic diagnosis being hemangio-endotheliosarcoma.

The roentgenographic findings described are: considerable enlargement of cardiac shadow before removal of pericardial fluid, and after removal of pericardial fluid and introduction of air into pericardial cavity a soft tissue shadow about 7.0 by 3.0 cm. in size was demonstrated anteriorly in the lateral view. The heart was about normal size. The pericardial fluid was blood-tinged and tumor cells were demonstrated microscopically.—*D. S. Kellogg, M.D.*

Dotter, Charles T., and Steinberg, Israel. The angiocardiographic measurement of the normal great vessels. *Radiology*, March, 1949, *52*, 353–358.

The caliber of the aorta of 100 apparently normal individuals was measured. The left anterior oblique projection was found the most satisfactory position. The ascending aorta varied in transverse diameter from 16 to 38 mm.; average 28.6 mm. Measurements are also given for the transverse, descending and diaphragmatic aorta. It was found that as age increased the caliber increased.

The pulmonary conus, main stem pulmonary artery, at their mid point, were best measured in left lateral and left anterior oblique projections. The right pulmonary artery is best visualized in the frontal projection. The caliber varied between 17 and 30 mm.; average 23.4 mm. There was no relationship between caliber and age of the individual.

The superior vena cava was measured in the frontal projection as it crossed the right pulmonary artery. The measurement often varied as much as 6 mm. in the same person on different examinations. The average caliber was 13. mm.—*Vernon L. Peterson, M.D.*

Jacobs, Lewis G. A new standard for heart size measurement. *Radiology*, Jan., 1949, *52*, 103–106.

The author proposes a new standard for heart size measurement based on the transverse diameter of the chest, the length of the aerated lung, and the age. He believes this is preferable to the use of height, weight and age, as two of the factors are obtainable from the film, leaving only the age to be obtained from the patient. Predictions based on these two sets of factors are about equal in accuracy. Prediction tables are presented, the prediction being for the maximum normal transverse diameter of the heart instead of for the average normal.—*D. S. Kellogg, M.D.*

Bosco, Guillermo. La localización electiva del infarto del miocardio en el ventrículo izquierdo. (The elective localization of the infarct of the myocardium in the left ventricle.) *Brasil méd-cir.*, March, 1948, *10*, 119–138.

The author intends to prove by means of arterioroentgenography, electrocardiograms, clinical examinations and autopsy findings that infarct of the myocardium is exclusively an affection of the left ventricle. Even the condition which the pathologists and the clinicians have described as "infarct of the right ventricle" is in reality only an infarct of the left ventricle which has extended to that definite area of the left ventricular wall and, occasionally, of the same auricle whose circulation is provided by the left circumflex artery of the so-called anomalous type. Consequently Bosco recognizes three syndromes of acute myo-

cardial infarct: (1) the lateral coronary syndrome with brusque occlusion of the left circumflex artery of "normal type" distribution, (2) the anterior coronary syndrome due to complete acute obstruction of the anterior descending artery, and (3) the posterior coronary syndrome originating in the left circumflex artery of the "anomalous type" distribution. No coronary syndrome due to acute occlusion of the right circumflex artery is recognized by the author.—*Ernst Schmidt, M.D.*

Sellors, T. Holmes, Radiology in heart surgery, *Brit. J. Radiol.*, May, 1948, *21*, 226–235.

The place of comprehensive roentgen examination in the diagnosis and later assessment of efficacy of treatment in heart surgery is presented. Close collaboration of the physician, radiologist, and surgeon is mandatory. The principal lesions amenable to surgical treatment at present are certain forms of congenital heart disease and cardiac compression. Tumors and vascular lesions in the mediastinum must be differentiated from cardiac abnormalities in some cases. Pericardial abnormalities such as tumors, cysts, pericardial deficiency, and effusion are mentioned.

Cardiac compression may result from traumatism, acute and chronic pericardial effusions, polyserositis and constrictive pericarditis.

Congenital lesions discussed include patent ductus arteriosus, coarctation of the aorta, and the tetralogy of Fallot.

The roentgen appearance of the above lesions and the benefits from surgical treatment are discussed.—*K. L. Krabbenhoft, M.D.*

Jorup, Sigvard. Congenital varices of the esophagus. *Acta paediat.*, March, 1948, *35*, 247–257.

In his review of the literature the author found only 3 cases meeting the criteria of congenital esophageal varices, i.e., vomiting, small early attacks of hematemesis, varices present in the first month of life and demonstrable by roentgenography, no portal stasis, and no blood disorders except for a possible secondary anemia.

To these he adds his case of a three year old boy who from birth took little nourishment and vomited frequently. After two months the vomitus showed brownish discoloration and was sometimes blood streaked. Roentgen examination showed irregular rarefied areas in a wide-lumened esophagus, and retarded evacuation of barium. Thorough study of the patient showed no other pathology and specifically no evidence of portal hypertension.—*Joseph Jorgens, M.D.*

Castleton, Kenneth B., and Dolowitz, David A. Peptic ulcer of the esophagus with severe bleeding, controlled by oxycel. *Gastroenterology*, May, 1948, *10*, 797–800.

Peptic ulcer of the lower end of the esophagus probably occurs more commonly than has been generally suspected. A case is reported of bleeding esophageal ulcer in which the artery was observed through the esophagoscope. The hemorrhage was so severe that preoperative transfusions of 2,500 cc. of blood did not prevent the patient from being virtually exsanguinated. Oxycel applied topically was successful in controlling the hemorrhage. Subtotal gastric resection had been performed in the mistaken belief that bleeding was gastric or duodenal in origin. It is suggested that in cases where diagnosis is uncertain preoperative esophagoscopy may be of value. It is suggested that local application of oxycel may be used to control bleeding from esophageal varices as well as from ulcers.—*Franz J. Lust, M.D.*

Jemerin, E. E., and Aronoff, J. S. Foreign body in thyroid following perforation of esophagus. *Surgery*, Jan., 1949, *25*, 52–59.

The authors report 3 cases in each of which the cervical portion of the esophagus was perforated by an ingested foreign body which became lodged entirely within a lobe of the thyroid. No other such cases have been reported. The patients showed abscess formation primarily within the thyroid gland rather than in a periesophageal site. In 2 cases the abscess was putrid while in 1 it was odorless.

Diagnosis of the lesion may be obvious if there is a history of ingestion of a foreign body followed by pain in the neck, dysphagia and fever. Physical signs are those of an inflammatory process in the neck. In the 3 cases it was largely confined to a lateral lobe of the thyroid. The lateral roentgenogram usually shows widening of the retrotracheal space, but because in these cases there is apparently less tendency for infection to travel down the retrovisceral compartment there is a tapering of the retrotracheal widening in the direction of the superior thoracic aperture. The anteroposterior

roentgenogram may show lateral displacement of the trachea.

The most likely site for perforation of the esophagus is in the posterior portion at the pharyngo-esophageal junction owing to the abrupt narrowing, the change in direction of the tube and the "V" shaped area in this region where there is an absence of the outer longitudinal layer of muscles. Lateral or anterior perforation is less likely when it is due to instrumentation. As pointed out by Myerson, an edentulous plated upper jaw may predispose to ingestion of a foreign body because of the loss of the discriminatory sensation.

Treatment consists of removal of the foreign body and external drainage.—*C. B. Holman, M.D.*

Bourne, W. A. Oesophageal lesions in sclerodactyly. *Lancet*, March 5, 1949, *1*, 392–394.

The author presents an excellent review of esophageal abnormalities produced by the more generalized disease, sclerodactyly. He presents excellent diagrammatic tracings of esophagrams showing four types of lesions. These lesions may easily simulate carcinoma of the esophagus or a cardiospasm.

Sclerodermatous lesions of the gastrointestinal tract first came into notice when Ehrmann described them in the esophagus in 1903. They are rare, but should be either recognized or suspected because, in what seems to be the majority of cases, they are associated with demonstrable Raymond's phenomenon progressing to sclerodactyly. This is the condition of hardened adherent finger tissues with atrophic changes at the tip, which, in its fully developed form, gives the characteristic roentgen appearances of subcutaneous calcinosis and absorption of the terminal phalanges.

The organic changes are interesting when the cardia is not affected, but the esophagus itself is involved. Peristalsis is likely to be abolished and all tone disappear. The esophagus then dilates passively when food is taken until sufficient hydrostatic pressure develops for its contents to empty into the stomach. The pressure is not greater than normal and no symptoms may be presented except the inability to swallow in the horizontal position. The esophageal wall may become so lax that it is common to find a spontaneous distention of the esophagus with air, presumably from negative intrathoracic pressure, aerophagy, or both. This appearance is probably quite rare in other conditions.

Another common finding is the short esophageal type of hiatus hernia which was present in half of the Mayo Clinic series.

An esophageal ulcer seems to be a fairly common finding in these cases. It is not uncommon to find a traction deformity of the upper esophagus due to sclerodermatous pulmonary fibrosis. The lower two-thirds of the esophagus is much more commonly affected, but the appearances in this region are often less regular and less localized. The irregularity in this region frequently simulates carcinoma. Intestinal changes may also be present and be demonstrated roentgenologically.

The diagnosis is difficult. Dysphagia of the Plummer-Vincent type may appear as a secondary result. Pulmonary fibrosis is frequent. The skin changes have already been mentioned.

This article is a good review of these rare but frequently difficult diagnostic problems involving the esophagus and intestinal tract.—*J. S. Summers, M.D.*

Ustvedt, H. J. Further investigations respecting bilateral hilar adenitis. *Acta med. Scandinav.*, Feb., 1949, *132*, 415–430.

Bilateral hilar adenitis, with or without *E. nodosum* at the same time, occurring in cases where there is no material for biopsy or characteristic affections of other organs, will not quite infrequently be due to tuberculosis, especially where the tuberculin reaction is strongly positive, but also where it is weak or negative. Boeck's sarcoid will far less often be present and only where the tuberculin reactions are weak or negative. A large number of the cases are characterized by joint affections, and there is a separate group which together with unilateral hilar adenitis, *E. nodosum*, *E. multiforme* and polyarthritis acuta may possibly bear relation to rheumatic fever.—*Charles Nice, M.D.*

Ravitch, Mark M. The operative treatment of pectus excavatum. *Ann. Surg.*, April, 1949, *129*, 429–444.

In treating 8 children with pectus excavatum or funnel breast the author gives a full description of the condition and the operative procedure for correcting it. The indications for operation are listed as (1) cosmetic, (2) orthopedic, and (3) physiologic. Early operation is stressed for best results in preventing

general thoracic deformity and physiologic disturbances or dyspnea, exercise intolerance and cardiac arrhythmias which may appear during adolescence. The author states it is impossible to predict in which cases the deformity will progress.

In the operative procedure the deformed portions of all the involved costal cartilages are removed, the xiphisternal articulation and substernal ligament are divided, and the body of the sternum is elevated into normal position. No external traction or cast are used.

The results have been excellent in seven cases as illustrated by preoperative and postoperative photographs and roentgenograms.—*T. D. Allison, M.D.*

Postlethwait, R. W., Hagerty, R. F., and Trent, J. C. Endobronchial polypoid hamartochondroma. *Surgery*, Oct., 1948, *24*, 732–738.

Endobronchial polypoid hamartochondromas are differentiated from intrapulmonary hamartomas because they may cause severe symptoms early and some may be removed through the bronchoscope. The authors add another case to the 13 previously reported in the literature. A diagram shows that in all cases these lesions were located in large or stem bronchi. They are pink, spherical, nodular and polypoid lesions. There is abundant cartilaginous tissue, frequently in plaques surrounded by fat, cavernous vascular spaces and connective tissue. There may be some ossification. They are encapsulated and covered by bronchial epithelium and show no erosion or invasion. They are said by some to originate from bronchial rings, while others favor an embryonal anlage because of the occasional presence of elastic fibers.

Symptoms may result from obstruction causing atelectasis, pneumonitis, bronchiectasis or pulmonary abscess, or they may result from the tumor itself causing cough, wheezing, pain in the chest, dyspnea, sputum, hemoptysis or "streaking."

Roentgenologic examination is of value in demonstrating the obstructive features. Bronchography was used in some cases. The tumor was visualized bronchoscopically in 6 patients.

Treatment consists of bronchoscopic removal or lobectomy.

A table summarizes the important data in the 13 previously reported cases and a report of the authors' case is given.—*C. B. Holman, M.D.*

Vickers, A. A. Bronchography. *Brit. J. Radiol.*, March, 1949, *22*, 137–233.

A comprehensive review of the methods for performing bronchography, their advantages and undesirable features is presented. In the preliminary preparation of the patient, the question of iodism secondary to absorption of iodine from the medium employed should be considered. However, in the unanesthetized patient most of the oil is coughed up, and since it has been shown that iodine is not absorbed from the lung, the only possible route of absorption is the gastrointestinal tract, *i.e.* breakdown in the intestine of oil swallowed by the patient during bronchography. Preliminary postural drainage is unnecessary owing to the high density of iodized oil which will always displace mucopurulent secretions; posture will not displace a thick mucus plug in a bronchus. Suppression of the central cough reflex may be attained by the use of codeine. Pharyngeal anesthesia is produced by use of an atomizing spray of one of several compounds (the author prefers 1 per cent amethocaine HCl). Laryngotracheal-bronchial anesthetization is accomplished by the same solution. A preliminary spray of the larynx during forced expiration will cause inspiration and coughing with a fine coating of the larynx with the solution. The solution is then run onto the larynx directly during expiration, and subsequent inspirations will disperse the anesthetic drug throughout the tracheobronchial tree (5 cc. is usually sufficient). For all methodes of bronchography local anesthesia is usually sufficient; infants, children and difficult adults may require general anesthesia. Iodized oil at room temperature is never too viscid; if warmed too much, flooding of the alveoli will occur.

The several methods of bronchography are:

(1) Cricothyroid route: Following subcutaneous local anesthetization, a bayonet needle with attached syringe is passed through the cricothyroid membrane and the larynx entered. The neck is held in extension during the procedure, but the patient may be positioned at will, except that in the extreme Trendelenburg position the oil tends to run into the pharynx. The writer reserves this method for ill and unconscious patients in whom intubation is impossible or undesirable. Local sepsis is an obvious contraindication and an annoying subsequent complication.

(2) Passive deglutition: No premedication is

given. Careful anesthetization of the faucial pillars and oropharynx by swabbing; anesthesia of the upper orifice of the esophagus is avoided. Anesthesia is complete when the patient cannot elevate the larynx. At the height of anesthesia the patient is given 15–30 cc. of iodized oil to swallow. The oil fills the valleculae and pyriform fossae and then spills into the larynx and trachea. This method is attractive because of its relative simplicity, but careful anesthetization is essential if esophageal spill is to be avoided.

(3) Peroral supraglottic route: "Psychic anesthesia" of the patient may be sufficient, but local pharyngeal, laryngeal and tracheal desensitization is usually required. Oil is instilled through a straight or curved cannula; the patient holds his own tongue, is asked not to cough or swallow. The iodized oil is dropped behind the tongue; the pyriform fossae fill and then the oil overflows onto the aryepiglottic folds and into the larynx. Adequate posturing for filling the various portions of the bronchial tree is readily attained. Contraindications and complications of this method are unknown.

(4) Peroral transglottic cannularization: Similar to the above method, but requires the passage of a rigid laryngeal cannula under indirect laryngoscopy.

(5) Peroral endotracheal catheterization: Passage of a flexible catheter under indirect laryngoscopy through the anesthetized larynx; used with great success with patients under anesthesia. Fluoroscopic manipulation of the catheter into either main bronchus and subsequent injection under fluoroscopic guidance.

(6) Bronchoscopic method: Injection of oil by cannula through a bronchoscope into a particular bronchus or bronchial branch. This may result in flooding of the area with oil. The author believes that bronchography should be performed first and the bronchograms used as a guide by the bronchoscopist in studying the area of suspected disease.

(7) Pernasal supraglottic instillation: Local pharyngeal and laryngeal anesthesia by the usual spray method and injection through a rubber nozzle which is fitted into one nostril. With the head extended, the oil runs back into the oropharnyx and thence fills the pyriform sinus as in the peroral method.

(8) Pernasal endotracheal catheterization: Anesthetization by the usual method of spraying and blind intubation of the anesthetized larynx. The patient is in the erect position, the catheter dipped into oil to render it visible fluoroscopically and then inserted into one nostril. The head is extended and the catheter advanced until it reaches the vestibule of the larynx. During inspiration the catheter is pushed into the larynx and the neck is then flexed while it is passed into the main bronchus on either side.

The routine of sequence of postures for filling of the various portions of the bronchial tree is tabulated in detail. The total amount of oil for complete bronchography is about 20 cc. with an additional 10 cc. if the upper lobes do not fill by reflux from the lower lobes when the patient is inverted.

The author concludes that in routine bronchography there is no place for the bronchoscopic method, and that in all except a questionable minority of cases the cricothyroid method is unnecessary. Excellent films illustrate the pathway of the opaque oil and the resultant bronchograms in selected cases illustrating the methods described.—*Harold Fulton, M.D.*

Coates, E. Osborne. Bronchoscopy in pulmonary tuberculosis. A study of post-bronchoscopic increase of disease. *Am. Rev. Tuberc.*, Oct., 1948, *58*, 412–420.

In a series of 473 bronchoscopies in 233 patients at Trudeau Sanitarium, the author concludes that the incidence of roengten increase of disease in the two months immediately following bronchoscopy was no greater than that in other two-month periods preceding bronchoscopy. Similarly, there was no tendency to post-bronchoscopic increases to occur more readily in advanced cases, nor did progression of disease prior to the bronchoscopy lead to a higher incidence of increases in the two months following the procedure.

It was noted that there was a lowered incidence of increase of the tuberculosis following bronchoscopy, as compared to the period before bronchoscopy, but since collapse therapy was frequently initiated following bronchoscopy, this was not considered significant.—*Lois Cowan Collins, M.D.*

Vaccarezza, Raúl F., and Paso, Juan R. Complejo bipolar neumonoganglionar por diseminación hemática precoz. (Bipolar pneumonoganglionar complex by premature hematogenous dissemination.) *An. Cáted. de pat. y clín. tuberc.*, Dec., 1947, *9*, 215–225.

Occasionally focal lesions resulting from hematogenous dissemination in a primary tuberculous infection may be accompanied by a satellite caseous lymph node, thus constituting a subprimary bipolar complex. The clinical and pulmonary roentgen findings in a case of primary tuberculosis of the conjunctiva, observed in a ten-year old boy, are desbcribed in detail. Particular reference is made to the pathogenic and etiologic factors of this complex.—*E. A. Schmidt, M.D.*

Willcox, A. Inhalation of stomach contents. *Lancet*, March 12, 1949, *1*, 438–439.

This is a report of 2 cases. Each was an obstetrical case. And each inhaled gastric contents during an anesthetic at the time of delivery. In both cases, there was a critical illness during the first twenty-four hours. The roentgenogram showed a patchy consolidation at both bases which helped to rule out the clinically suspected left ventricular failure.

Studies on animals showed a bronchiolar spasm and peribronchial congestion of the lungs similar to a phosgene poisoning. It therefore seems that the acid in the gastric juice acts as a lung irritant like phosgene. It causes a pulmonary edema.

This possibility must be considered in any postoperative roentgenogram of the chest showing a patchy consolidation. This is especially true if its distribution is in the lower zones of both lung fields.—*J. S. Summers, M.D.*

Oosthuizen, S. F., and Fainsinger, M. H. Pulmonary actinomycosis. *Brit. J. Radiol.*, March, 1949, *22*, 152–155.

The thorax is said to be the primary site of infection in 1 out of every 7 cases of actinomycosis. Primary thoracic infection occurs from inhalation of *Actinomyces bovis*. Secondary spread may occur by penetration of the esophageal wall, from cervical glands, invasion from a retroperitoneal abscess or hepatic abscess, or by blood stream dissemination. Roentgenographically there are few diagnostic features of pulmonary actinomycosis. (1) When the bronchial wall alone is involved, there are no changes in the lung fields, but in some cases, dilated or prominent bronchi may be visible. (2) With lung tissue involvement there may be consolidation, infiltration or nodulation (miliary or coarse). Abscess formation is common. (3) Bands of thickened pleura, adhesions and effusions characterize pleural involvement. Effusions rapidly become purulent and result in empyema with invasion of the bones forming the thoracic cage or sinus tract formation. (4) In the mediastinal type, there are prominent hilar shadows with peribronchial thickening which may extend into the lung fields. Bony erosion occurs often, as does sinus and sequestrum formation. The presence of bony lesions of the thoracic cage coexisting with a chronic lung lesion should suggest pulmonary actinomycosis.

Three cases, occurring in South Africa, are presented briefly. The first exhibited a lung abscess with a peculiar tract leading peripherally; the second showed multiple lung abscesses and dilated bronchi; a third a mediastinal effusion. The diagnoses were confirmed microscopically by demonstration of ray fungi in the sputum of the first two cases and pleural fluid in the third. All responded well to penicillin.—*Harold Fulton, M.D.*

Johnstone, Rutherford T. Pulmonary affections of occupational origin. *Am. Rev. Tuberc.*, Oct., 1948, *58*, 375–392.

The vast majority of substances found within an industrial environment cause no appreciable harm to pulmonary tissue. The diagnosis of pneumoconiosis on the basis of the roentgenogram alone is subject to considerable error.

Although many dusts may cause some significant fibrosis, they are inert in the lungs and do not cause a proliferative fibrosis. These are termed "benign pneumoconioses" by this author, and not considered clinically significant. These inert dusts never cause true nodulation.

The dusts which act as irritants and cause a true proliferative fibrosis, or a chemical pneumonitis, are considered individually. Silicosis and asbestosis are not included, except by name, since they have been so extensively treated in other publications. The inert dusts discussed are iron dust, cement dust, cotton dust, bagasse, fiberglas, and very briefly, grain or malt dust, carbon, calcium carbonate, magnesium carbonate, tobacco and sugar. It is noted, however, that many of these dusts may act as allergens, and may produce signs and symptoms by virtue of the allergic reaction in the lungs. In addition, certain molds may occur in conjunction with some of these dusts and account for pulmonary symptoms.

In the group which produces a chemical pneumonitis, the following substances are discussed: bauxite, diatomaceous earth, beryllium, and cadmium. Bauxite and cadmium are a hazard only when subjected to high temperatures, under which condition the oxide is liberated. Cadmium oxide, when inhaled, is probably more lethal than any other metal. Diatomaceous earth is only harmful if the diatomite is calcined with certain fluxes, converting a portion of the amorphous (and harmless) silica into crystobalite (which is a crystalline silica and causes silicosis). It is uncertain whether the toxicity to beryllium is to the metal itself or to its acid radicals. The pneumonitis it causes may be acute, or very late in appearance.

The incidence and morbidity of tuberculosis is not increased by an industrial environment (with the exception of silica industries, which are not discussed in this article).—*Lois Cowan Collins, M.D.*

Lister, W. A. Chronic bronchitis, never a complete diagnosis, *Lancet*, April 30, 1949, *1*, 719–721.

This article is of interest to radiologists only in its contention that there is seldom any occasion to use the term chronic bronchitis as a diagnostic term. The author suggests that it is frequently used to misdiagnose (1) a mild degree of left ventricular heart failure, (2) a focus of sepsis in the upper respiratory tract, (3) a chronic senile phthisis, (4) a bronchitis due to direct irritation, as smoking, or (5) an asthmatic condition.

The author believes that if the first four diseases can be excluded, then it is probable that one is dealing with a mild case of asthma in which the classical paroxysms of dyspnea are not a feature. If purulent infection is present, it is to be regarded as secondary and an attempt should be made to deal with it by means of antibiotics, but also treat the asthma.

This paper is not a scientific investigation, but his idea that physicians should be taught to distrust chronic bronchitis as a complete diagnosis is a good theme and well carried out.—*J. S. Summers, M.D.*

Delarue, Norman C., and Graham, Evarts A. Alveolar cell carcinoma of the lung. *J. Thoracic Surg.*, April, 1949, *18*, 237–251.

The authors present a brief review dealing with a specific type of pulmonary neoplasm which is characterized by a reproduction of the alveolar structure of the lung. The evidence is discussed which favors recognition of the multicentric nature of the lesion and seems to indicate that it may quite properly be called an "alveolar cell carcinoma." An illustrative typical case is reported which demonstrates the slow growth of the neoplasm and the palliation which may result from the removal of the diseased tissue, although the manifestations of the disease may reappear several years later in a different part of the lungs, as in this case. Attention is also called to the similarity of this case to jagziekte, the South African disease of sheep.—*Frederick M. Reis, M.D.*

Findlay, Charles W., Lehman, William L., and Rottenberg, Louis A. Gumma of the lung. *Ann. Surg.*, Feb., 1949, *129*, 274–284.

Acquired syphilis of the lung is extremely rare, and very few cases of pulmonary gummata have been verified by pathological study. The symptomatology of pulmonary gumma is nonspecific, and the roentgen changes are very similar to those usually seen in tuberculosis, chronic pneumonitis, fibrosis and bronchial neoplasm. In the case reported, a thirty-nine year old Negro male had a positive luetic history, chronic pulmonary symptoms and a roentgen shadow which closely simulated that of a bronchial neoplasm. Following a month of medical treatment, the thoracic lesion improved only slightly, and because of the strong likelihood of bronchial neoplasm, a thoracotomy was performed and a left lower lobe lobectomy was done. The surgical specimen is described and an interesting discussion of the subject is presented.—*C. L. Hinkel, M.D.*

Quist-Hanssen, S. Mutual compression of the right main bronchus and an abnormal left pulmonary artery as causes of the death of a seven-week-old child. *Acta paediat.*, 1949, *37*, 87–94.

This is a case history of a male baby who from birth had repeated attacks of cyanosis and dyspnea without stridor. He died at seven weeks of age, his condition being aggravated by an upper respiratory infection. Roentgen examination of the lungs two days after birth showed obstructive findings consisting of upper and middle lobe atelectasis and lower lobe emphysema, followed several weeks later by emphysema of the entire right lung.

The autopsy examination showed an abnor-

mal left pulmonary artery. The obliterated ductus arteriosus arose from the truncus pulmonalis and led in a normal manner to the aortic arch. The right pulmonary artery was in its normal postion dividing at the hilum into its usual branches. However, medial to the first artery to the right lung, a large vessel, the anomalous left pulmonary artery, arose, crossed over the right main bronchus, and passed to the left behind the bifurcation of the trachea and the left main bronchus into the left hilum, there branching in the usual manner. The cyanosis and dyspnea were due to compression of the lumens of the right bronchus and the abnormal left artery.

The author believes that surgery could alleviate such a condition.—*Joseph Jorgens, M.D.*

Hansen, Jens L. Pulmonary abscesses attended with pleural complications. *Acta chir. Scandinav.* June 28, 1948, *96*, 493–508.

This report covers 100 consecutive cases of pulmonary abscess, observed over the three year period from 1944 to 1946 inclusive, in the Öresund Hospital in Copenhagen. All forms of pulmonary abscess are surveyed, including those co-existing with bronchial carcinoma, bronchiectasis, etc., where the abscess dominates the clinical syndrome. Tuberculosis, however, is specifically excluded.

Of these 100 cases observed, 32 developed some form of pleural complication. Five of the complications were non-bacterial in nature, comprising 2 cases of pneumothorax, and 3 cases of sterile effusion. Among the remaining 27 cases there were 15 cases of loculated empyema, and 12 cases of total empyema.

If the author's material is broken down in an attempt to classify the pulmonary abscesses into etiological types, it is found that the incidence of pleural complication is the same (27 per cent) in the presence as well as in the absence of stenosing bronchial affection. The highest incidence of pleural complication occurred in the cases with bronchiectasis (80 per cent), but the author feels that this was in part due to the criteria of selection, since the material did not include those cases of small, multiple, bronchiectatic abscesses found only at operation or autopsy.

An analysis of the age and sex incidence of pleural complications in pulmonary abscess revealed no essential difference between the two sexes, but showed the highest incidence of pleural complications in children and adolescents. Although the number of cases in the author's analysis is too small to statistically substantiate this latter finding, Semb and other authors have reported the same experience.

The location of the abscess appeared to play a large part in determining the presence or absence of pleural complications. Abscesses located in the lower lobes developed these complications more than twice as often as those located in other lobes. Hansen ascribes this to the greater respiratory excursions of the lower lobes with less opportunity for synechial formation in these parts.

The pathogenesis of the pleural complication was clearly evident in 21 cases where rupture could be demonstrated with certainty. In 4 other cases the clinical and roentgenological symptoms were highly suggestive of rupture. In the remaining 6 cases the question of rupture or lymphogenous propagation remained open. It is interesting to note that in 3 of the cases with proved rupture of a pulmonary abscess, there was no evidence of bacterial infection of the pleura, although pneumothorax was present in 2 of these cases, and effusion in the other. The author also points out that many of his cases exhibited organisms in the pleura different from those in the sputum. The most common organism found in the pleural effusion was the non-hemolytic streptococcus.

In most of the cases in this series roentgenography revealed only a large pleural effusion after the onset of the pleural complication. Distinct outlines of the abscess were observed in only 10 cases at the outset. The author feels that in his experience, as well as that of some others, pyopneumothorax is more indicative of a pulmonary abscess which has ruptured to the pleural cavity than of a primary empyema forcing its way to the bronchi.

The treatment in these cases was primarily directed against the pleural complication, and, as a rule, took the form of rib resection with suction drainage, and antibiotic therapy. In 8 cases, pneumonotomy was performed at the same time as the pleural drainage. Nineteen of the 32 patients are alive and well in a follow-up period ranging from one to three years.—*E. C. Lasser, M.D.*

Liavaag, Kaare. Gastro-bronchial fistula; report of a case. *Acta. chir. Scandinav.*, April 30, 1948, *96*, 425–430.

A male, aged thirty-six, was struck by a bomb fragment with resultant injury to the left

kidney, and perforations of the pleura and peritoneum on the left. A nephrectomy was performed, and the patient left the hospital after three months' convalescence, to return a week later with a traumatic diaphragmatic hernia on the same side. This was repaired, but another rent in the diaphragm noted at the time of surgery was left intact.

Three years later the patient again returned with a history of hemoptysis. An upper gastrointestinal examination revealed a diaphragmatic hernia. Two pouches resembling diverticula protruded from the stomach. One of these communicated with an intrapleural cavity and through it with the bronchial tree.

The diaphragmatic hernia was repaired, and left lower lobectomy performed because of the extent of the fistulous tract. The author assumes that the fistula resulted from incarceration of the stomach in the diaphragmatic hernia, and that the hemoptysis could be attributed to the peptic action of hydrochloric acid on the bronchoplumonary tissue.—*E. C. Lasser, M.D.*

Vaccarezza, Raúl F., and Raimondi, Alejandro. Fistulas broncopleurocutáneas de origne tuberculoso tratadas con éxito con estreptomicina. (Bronchopleurocutaneous fistulae of tuberculous origin, successfully treated with streptomycin.) *An. Cáted. de pat. y clín. tuberc.*, Dec., 1947, *9*, 264–269.

The authors present the roentgenograms and clinical features of a case with two bronchopleurocutaneous fistulae in a twenty-three year old tuberculous woman following thoracoplasty, tuberculous empyema and peripleuritis. Both fistulae, which had persisted without evidence of healing tendency for six months and nineteen months, respectively, closed in less than thirty days after parenteral administrations of daily doses of 2 grams of streptomycin. Since at first the streptomycin tolerance was poor and the injections had to be suspended for two weeks, the total period of injections amounted to sixty days. While the body temperature returned to normal during the treatment, the expectoration and positive sputum findings remained unchanged.—*E. A. Schmidt, M.D.*

Johnson, C. R., Clagett, O. T., and Good, C. A. The importance of exploratory thoracotomy in the diagnosis of certain pulmonary lesions. *Surgery*, Feb., 1949, *25*, 218–230.

In 114 of 384 cases in which patients were operated on primarily for pulmonary lesions, a definite preoperative diagnosis could not be made. These 114 cases are the subject of this study. In 3 cases the diagnosis was indeterminate after surgical and pathologic investigation. All patients were thoroughly studied by means of a complete histories, physical examination, examination of the blood, urine and serum, stereoscopic posteroanterior roentgenograms of the thorax, and any additional procedures indicated such as bronchoscopy, bronchography, roentgenograms made using the Potter-Bucky diaphragm and body section roentgenography. In most cases, tuberculin skin tests and examination of the sputum for acid-fast bacilli and fungi were performed, if possible, and in some cases the sputum was examined for malignant cells, although most of these cases were studied before this very valuable procedure in the hands of a skilled cytologist had been developed for general use.

The cases were divided into 3 groups based on the roentgenologic and bronchoscopic data. The first group, comprising those with a roentgenologically demonstrable mass situated peripheral to the region of bronchoscopic visualization, showed no definite roentgenologic or clinical criteria to distinguish between malignancy and benignancy. Seventy-four per cent of the group proved to have malignant lesions. The second group, having lesions secondary to bronchial obstruction, all had some symptoms of pulmonary disease. More than half of the patients showed some degree of atelectasis roentgenologically and the rest were variously described as having an inflammatory, infiltrative, cavitating or consolidative process. Fifty per cent of these lesions were malignant. The third group was composed of 10 miscellaneous cases in which no mass or evidence of bronchial obstruction could be demonstrated. The differential diagnostic possibilities included nonspecific inflammatory changes which would subside, neoplasm and irreversible inflammatory changes. Carcinoma was present in 2 of the 10 cases, suppuration and abscess in 3 cases, lipoid pneumonitis in 1 case and silicotic stricture in 1 case. The lesion was inoperable in 28 per cent of the first group and in 46 per cent of the second group.

The authors concluded that although the roentgenologic examination is most important in apprehending a pulmonary lesion, it is not a means of exact diagnosis. Bronchogenic carcinoma may be present in spite of a normal

thoracic roentgenogram. A period of observation may be a diagnostic aid in some of these cases but it should not exceed four weeks because an inflammatory process should subside in that time. Too long a period may be fatal if carcinoma is present.

There were no deaths among the 25 patients who underwent exploratory thoracotomy. Only 6 deaths followed pneumonectomy and 2 deaths followed lobectomy. These deaths all followed thoracotomy undertaken for therapeutic, rather than diagnostic, considerations.—*C. B. Holman, M.D.,*

Rosemond, G. P., Burnett, W. E., and Hall, J. H. Value and limitations of aspiration biopsy for lung lesions. *Radiology*, April, 1949, *52*, 506–510.

The experience of the authors in needle biopsy of lung lesions is based on 272 lung lesions. They point out that all patients should have a bronchoscopic attempt to make a diagnosis before needle biopsy is attempted. Pathological examinations of lung secretions should also be made before needle biopsy in an attempt to make a diagnosis. A positive diagnosis should be obtained, if possible, in all instances before exploration is attempted by thoracotomy. The authors have not found one instance in which they believe tumor spread has occurred along the needle tract. Another supposed hazard of producing an empyema has not occurred in any one of their patients.

The most common hazard has been pneumothorax, and this complication accounted for one death in this series. Hemorrhage into lung parenchyma from traversing pulmonary vessels has not occurred.

For accurate localization the lesion must be visualized fluoroscopically in two planes, thus a biplane or multiplane fluoroscope is essential. The details of the procedure are outlined.

Of the 220 patients suspected of having lung carcinoma, 135 were proved by needle biopsy. There was only one false positive in the whole group, and this proved later to be a lymphoblastoma. It apparently is difficult to get an adequate specimen from a lymphoblastoma mass as the tumor is so dense. Out of the group there were 20 cases in which there were complications as a result of the biopsy. Three patients died shortly after the procedure; one a cardiac death, one a tension pneumothorax, and in the third no adequate explanation could be accounted at autopsy.—*E. A. Addington, M.D.*

Neuhof, Harold, Sussman, M. L., and Nabatoff, R. A. Angiocardiography in the differential diagnosis of pulmonary neoplasms. *Surgery*, Feb., 1949, *25*, 178–183.

The authors present data from a study now in progress in which by means of contrast visualization alterations of the pulmonary vascular pattern due to pulmonary neoplasms are observed. The procedure is that described by Robb and Steinberg to which a multiple roentgen exposure technique has been added. The development of criteria for the differential diagnosis of various intrathoracic neoplasms was aided by comparison with roentgenograms made of the surgical specimens in which the pulmonary arteries were injected with radiopaque material.

Infiltrative malignant lesions of the main bronchi are usually associated with compression, irregular distortion and varying degrees of obstruction of the major branches of the pulmonary artery at the site of the lesion. Such lesions arising from small bronchi may cause similar changes in the smaller branches of the pulmonary artery. Well circumscribed tumors may show spreading apart of the adjacent vessels. These may appear to encircle the lesion. The angiograms indicate no significant changes of the adjacent vessels in the case of mediastinal and pleural tumors.—*C. B. Holman, M.D.*

Keele, K. D. Angiocardiography in the diagnosis of congenital heart disease. *Brit. J. Radiol.*, Aug., 1948, *21*, 380–393.

The accurate diagnosis of congenital heart lesions has increased in importance with the advent of surgical methods of treatment. Angiocardiography is relatively new and aids immeasurably in the identification of these lesions and in the exclusion of other lesions which may be compensatory in nature. The author considers only acyanotic heart disease. A brief historical outline of the progress of angiocardiography is presented.

The technique used by the author is outlined:

(1) The patient is tested for sensitivity to pyelosil and anesthetized using oxygen and cyclopropane, employing an intratracheal tube.

(2) The patient is placed in the left anterior

oblique position and the left antecubital vein is exposed, inserting a large cannula.
(3) A preliminary film is exposed.
(4) 15–20 cc. of 70 per cent pyelosil is injected within two seconds.
(5) Eight films are taken during and after injection at one and one-half second intervals.
(6) Normal saline is then infused for 15–20 minutes.
(7) The patient is changed to the anteroposterior position and the process is repeated.

The films are exposed using 65 kv. (peak), 200 ma. and 1/20 second.

Anesthesia is used because of the intense sensation of heat, initial tachycardia, and vomiting which occur. Positioning is also facilitated in working with children. No toxic reaction of renal or hepatic nature has been observed.

The normal outlines of the right and left sides of the heart as seen in the anteroposterior and left anterior oblique positions using the above method are illustrated and discussed. The appearance of the contrast medium in the living subject as opposed to the outline of the cardiac chambers in the cadaveric form is modified by the following three factors: (1) systole and diastole, (2) tendency of the contrast agent to follow an axial steam, and (3) mixture with inflowing blood currents producing dilution.

Abnormal angiocardiograms with diagrammatic reproductions of the following conditions are presented: (1) coarctation of the aorta; (2) patent ductus arteriosus with complete heart block, (3) patent ductus arteriosus with pulmonary stenosis; (4) patent ductus arteriosus with patent interauricular septum, and (5) patent interventricular septum.

These findings have not been confirmed by autopsy. It is felt that angiocardiography should be employed in the diagnosis of all congenital heart lesions upon which surgery is contemplated. Clinical, roentgenological, and electrocardiographic diagnoses can thereby be further substantiated and coexistent defects may be discovered.—*K. L. Krabbenhoft, M.D.*

Brocklebank, J. A. Angiocardiography applied to congenital heart disease. *Brit. J. Radiol.*, Aug., 1948, *21*, 393–397.

A definition of angiocardiography and the purposes for which it is used are given.

In a series of nineteen examinations on 9 patients, all were children under fifteen years of age. Pyelosil, 70 per cent w/v (Glaxo) was used as a contrast agent. The examinations were performed under general anesthesia with cyclopropane and oxygen in a closed circuit, using a face-mask and an endotracheal tube. The patients received "seconal" or "nembutal" as a premedicant.

A preliminary film is exposed to check positioning in the wooden cassette tunnel, to determine the position of the endotracheal tube, to insure optimum exposure factors (2–3 kv. (peak) latitude is the most allowable), and to be used as a control in interpretation of the angiocardiogram. The injection is made within a two second period via the largest size cannula that will fit into the left antecubital vein, using 15–20 cc. of the contrast medium which has been heated to body temperature. Manual cassette changing is used. The films are exposed at 1½ second intervals, the period from one to eight seconds giving the most information. The smallest suitable cone is used to limit scatter and fogging of the film. The technical factors usually used are: 60–65 kv. (peak), 200 ma., 0.05 second, at a 40 inch focus-film distance, using a 4.5 mm. focus fixed anode tube and a 4-valve generator. Drip saline infusion is employed for about twenty minutes between injections of the medium to prevent clotting and allow adequate excretion of the medium. The patient is then placed in the next desired position and the procedure repeated. The closest attention to detail and smooth teamwork are essential.

The patient must be tested for sensitivity to the contrast agent. Reactions include a generalized sensation of heat, transient tachycardia, followed by mild bradycardia, and nausea, all of which are of no significance with the patient under anesthesia.

It is desirable to obtain a "bolus effect" to insure optimum visualization. To obtain the "bolus effect," the injection must be made rapidly and the amount injected must be sufficient. The left arm must be used and a compression or stretching of the axillary and subclavian vein must be avoided. The projection of choice is the left anterior oblique (of at least 45 degrees) for visualization of most abnormalities.

The physician and radiologist should view and discuss the films together to obtain the best interpretation.—*K. L. Krabbenhoft, M.D.*

ABDOMEN

Pack, G. T. Introduction to symposium on cancer of the esophagus and gastric cardia. *Surgery*, June, 1948, *23*, 867–873.

This is the introductory article to a symposium on the problems of diagnosis and surgical treatment of cancer of the esophagus and gastric cardia which may be read profitably by the radiologist. The author emphasizes the importance of the subject by stating that cancer of the esophagus occurs more frequently than all malignant neoplasms of bone, lip, tongue, larynx, or kidney. Approximately 10 per cent of the carcinomatous lesions in the region of the esophagogastric junction are now suitable for transthoracic esophagogastrostomy with some type of intrathoracic anastomosis.

Esophageal carcinoma resembles the intraoral group because the epidermoid is the common histopathologic type, the age and sex distribution is similar, and there is a common etiologic relationship to chronic irritation. Justifiable pessimism concerning treatment because of discouraging end results may be due to the following: (1) late diagnosis due to obscure symptoms; (2) infrequent esophagoscopy; (3) early malignant perforation of the esophageal wall; (4) frequent high grade of malignancy with early metastasis; (5) early inoperability; (6) patient is often a poor operative risk; (7) operative technique involves grave anatomic and physiologic considerations in addition to great skill, resourcefulness, judgment and special assistance and equipment; (8) radiation therapy as used in the United States gives only palliation. The author states that the use of the million volt apparatus is the most satisfactory method of management. His factors are: a distance of 70 cm., half-value layer of 3.8 mm. of lead; 4 rectangular ports; 300 r to 1 port daily until a total skin dose 3,000 r×4 has been administered.

A description is presented of the rotation roentgen therapy of esophageal cancer by Dr. Jens Nielsen, Chief of the Radium Center in Copenhagen, Denmark. The patient is turned at a uniform rate and the barium-filled esophagus is maintained in the axis of rotation by constant fluoroscopic control. He uses 180 kv. at 70 cm., with portals averaging 30 to 35 sq. cm., and half-value layer of 0.32 mm. Cu or 0.9 mm. Cu. For curative therapy 96 of 140 patients received a tumor dose of more than 4,000 r. Four-fifths of these had nearly complete freedom from symptoms immediately. Twenty-five per cent of patients were alive after one year in comparison to 10 per cent formerly, and 15 per cent survived for two years as compared to 4 per cent previously.—*C. B. Holman, M.D.*

Sherman, R. S. The roentgen diagnosis of cancer of the cardiac region of the stomach. *Surgey*, June, 1948, *23*, 874–883.

General principles in the roentgenologic diagnosis of gastric carcinoma include emphasis on roentgenoscopic study and use of the filming fluoroscope. Competence of the examiner is the most important consideration. Roentgenologic diagnosis depends on gross pathology; the three recognized types of gastric carcinoma are polypoid, ulcerative, and infiltrative. Functional changes are of little importance in the diagnosis of tumors of the gastric cardia. The detection of organic abnormality is the greatest contribution of gastric roentgenology; in the actual diagnosis roentgenology is generally less reliable. The most important judgment is an accurate appraisal as to whether the process is one for medical or surgical management. A correct evaluation of the reliability of roentgenologic examination is not gained by most statistical and comparative studies because of variations in ability of the examiner, neglect in judgment of technical methods, and inclusion of old and new material. A statement of the type of tumor, its location and extent of the complications is more valuable than an appraisal of resectability.

Familiarity with the roentgenologic anatomy is vital to dependable interpretation of disease in this region. A wide range of variation exists in the mucosal anatomy, superimposed on which may be changes related to respiration, alteration in intra-abdominal pressure, extrinsic pressure, gastric distention, functional alterations and type of media used. Roentgenologically the cardia includes a region about 1 inch square surrounding the esophageal orifice. Extending above a horizontal line through the upper limit of this region is the fundus, and below this line is the body. Developmental variations, of which the cascade stomach is an example, must be recognized.

A consideration of the technical aspects of the examination of this region is presented. Natural disadvantages include difficulty in palpation and absence of peristalsis. Advan-

tages include absence of local functional changes, the wide lumen containing air, close association with the left side of the diaphragm, occasionally cardiac and aortic pulsations, and changes in the lower esophagus such as obstruction, narrowing, stiffening of the wall, irregularity, mucosal change, ulceration and mass formation, which are frequently related to cancer of the cardia. A summary of roentgenoscopic technique is given. The author begins by carefully observing the air bubble for possible evidence of a tumor. First a thick suspension of barium is swallowed. Deep palpation with forced inspiration is used with the patient in both oblique and lateral positions. The procedures then are repeated with the patient in the horizontal position. With the patient in the erect position, subsequently, the mucosa is seen by a double contrast effect. The esophagus and stomach then are carefully observed as the patient drinks a mixture of barium the consistency of cream. No routine is established for roentgenographic examination but a careful technique is of fundamental importance in examining the upper third of the stomach. Sagittal and lateral views with the patient in the erect position are used.

Differential diagnosis includes peptic ulcer, lower esophageal tumor, herniation, obstructive lesion, cardiospasm, varices protruding into the esophageal and gastric lumens, gastric diverticulum, benign stenoses and involvement from an extrinsic tumor. Extrinsic pressure from adjacent organs also must be considered.

Tumor of the cardiac region was found in 22 per cent of 205 cases of carcinoma of the stomach at Memorial Hospital, New York. The author presents general considerations based on 25 recent cases. Mucosal alteration was the most constant finding and there was some evidence of infiltration in each case. In each of 16 cases a mass was present. Ulceration was of minor aid in diagnosis. Extension of cancerous lesions into the esophagus was found in 19 cases and suspected in 2 others. Other miscellaneous signs such as obstruction, gross changes in contour, general widening between the fundus and the dome of the diaphragm, lateral displacement of the stomach at the cardia and diaphragmatic alteration were not helpful in this series.

It is stated that "lymphosarcoma of the stomach cannot be differentiated from carcinoma with assurance on the roentgen findings alone." Myosarcoma is usually represented by a rounded mass with smooth mucosal surface and frequently shows ulceration or a sinus tract. It may be located anywhere in the stomach.

Roentgenologic findings in 10 cases after gastric cardiectomy are summarized. These included a change in the axis of the stomach as well as a reduction in its size. The duodenal bulb was usually on the left side of the abdomen with a vertical position of the pyloric canal. Emptying appeared to be passive and without effective peristalsis. In all but 1 case, anastomosis was done above the diaphragm.—*C. B. Holman, M.D.*

Kenworthy, R. A., and Welch, C. S. Leiomyoma of the esophagus and cardia of the stomach. *Surgery*, May, 1948, *23*, 745–752.

The authors report the case of a patient with a large leiomyoma of the gastric cardia and lower esophagus. They found 4 other cases reported in the literature. Small leiomyomas of the stomach are not uncommon, Meissner having reported such tumors in 46 per cent of 50 necropsies. These, however, seldom give rise to symptoms. The larger ones are frequently recognized on roentgenologic examination, their most alarming symptom being massive hemorrhage. Leiomyomas which involve both the stomach and esophagus may result in massive hemorrhage or chronic anemia from erosion of overlying gastric mucosa, or obstruction of the esophagus may predominate. The commonest symptom is dysphagia.

According to Moersch and Harrington the leiomyoma is the commonest benign esophageal tumor. The commonest sites are the upper and lower thirds of the esophagus, the main groups being mucosal and extramucosal. They arise from smooth muscle; growth is slow, and the extramucosal tumors are slow to obstruct. No definite evidence of malignant degeneration is reported but malignant characteristics of such a tumor are not excluded.

Sommer in 1923 reported the only case diagnosed roentgenographically as a benign tumor because of its lobulated appearance. Smaller myomas show a smooth mucosal contour and absence of infiltration of the wall, while the larger polypoid tumors are surrounded by contrast medium. A bulky, mobile soft tissue mass attached to a deformed esophageal area, more or less bulging into the mediastinum, is characteristic of the benign intrinsic extramucosal

tumor and is unlike the fusiform contour of a stenosing carcinoma. They also may show bulging of the opposite wall, absence of undermining margins, smooth margins, various sizes and shapes of defects, absence of actual obstruction, presence of a smooth variable mold effect, absence of mucosal erosion over the tumor, normal mucosal folds in the immediate vicinity and observation of a barium ring or "ring sign."—*C. B. Holman, M. D.*

Moutier, François, and Nemours, Auguste. Le cancer sus-cardial et juxta-oesophagien de la grosse tuberosite gastrique. (Supracardiac carcinoma of the stomach.) *Arch. d. mal. de l'app. digestif.*, March–April, 1948, *37*, 137–163.

The authors stress the importance of adequate and meticulous examination of the upper pole of the stomach for better detection of lesions in this region. The reported frequency of such lesions comprises 10 to 12 per cent of all stomach carcinomas. These tumors are usually situated above the esophageal orifice and on the posterior wall of the fundus. Thus, the lesions by extension may surround and later invade the lower end of the esophagus. Therefore, dysphagia is only a late symptom of such involvement and often signifies an inoperable state. The authors distinguish between two forms of dysphagia—true dysphagia, constant and progressive in character and of mechanical origin due to compression or invasion of the esophagus and inconstant reflex dysphagia.

Roentgenographically, the cases are divided into two groups: those with patent cardia and those with stenosis of the cardia. There follows a very detailed description of the fluoroscopic and roentgenographic technique employed, the main stress being placed on the examination of the patient in the erect position. In this way, when the stomach air bubble is adequately studied, it is possible to detect early lesions of the cardia before the clinical symptom of dysphagia or its roentgenological counterpart, stenosis of the lower end of the esophagus, is present. Also, careful search for lesions in this area on routine chest examinations is desirable. —*Joan J. Lipsay, M.D.*

Pirkey, Everett L., and Roberts, Sava M. Diagnosis of primary Hodgkin's disease of the stomach. *Radiology*, Jan., 1949, *52*, 75–78.

This is a rare condition, the authors having found 22 cases reported in the literature, with their own making the twenty-third. They point out the similarity of the roentgen findings in this condition and in carcinoma of the stomach. The principal differential diagnostic criterion is the presence of polypoid-like masses which appear as numerous hemispherical filling defects. It is important that the radiologist bear this possibility in mind so that the patient will have a chance for operative cure. In the case reported by the authors the preoperative diagnosis was carcinoma, and operation revealed Hodgkin's disease of the stomach with extension into the esophagus and perigastric lymph nodes. The patient, aged sixty, died on the sixth postoperative day. Autopsy revealed no evidence of the disease elsewhere in the body.—*D. S. Kellogg, M.D.*

West, John P., and Knox, Graham. Neurogenic tumors of the stomach. *Surgery*, March, 1948, *23*, 450–466.

The authors report on 7 neurogenic tumors and 1 tumor of the smooth muscle of the stomach. The controversial histogenesis of these tumors is not discussed, the purpose of the paper being to emphasize the chief clinical manifestations and to comment on the possibility of malignant degeneration.

Three of the patients were men and 5 were women between the ages of forty-one and sixty-one years. Bleeding was the chief symptom in 6 cases and this resulted from central ulceration of the overlying gastric mucosa. One patient had some epigastric distress. Gastric analysis was not of definite value to differential diagnosis. Although a roentgenologic diagnosis of gastric tumor was made in 7 of 8 cases, only the smooth outline and frequent central area of ulceration could suggest the histopathologic diagnosis. Five tumors were located in the cardial and 3 in the pyloric segments. Two of the 8 tumors were considered as probably malignant microscopically. Because of the magnitude of gastric resection, the nature of the tumor should be determined at the time of operation so that local excision can be done when possible.

The paper contains excellent reproductions of the roentgenograms and of the photographs of gross and microscopic specimens.—*C. B. Holman, M.D.*

Poer, David H. Lymphosarcoma of the gastrointestinal tract. *Surgery*, March, 1948, *23*, 354–362.

A concise review of the general problem of lymphosarcoma of the gastrointestinal tract followed by an interesting report of a case of involvement of the duodenum suggesting perforated peptic ulceration is presented.

Lymphosarcoma, representing about half of the cases of gastric sarcomas, is divided into malignant lymphocytoma, which resembles lymphatic leukemia and may terminate as such; follicular lymphoblastoma, which is of low malignancy and quite radiosensitive, and the highly malignant reticulum-cell sarcoma. Grossly, the lesions may be polypoid and may cause partial obstruction, intussusception or volvulus, or they may be intramural and infiltrative causing annular growths replacing the muscularis and submucosa. These latter types may ulcerate, cause dilatation as the nervous and muscular tissues are replaced and result in a thick-walled appearance or they may produce stenosis. The stomach is the most frequent site, followed by the ileum, jejunum and cecum. The chief criteria for clinical differential diagnosis with respect to carcinoma are a more rapidly retrogressive course, rarely complete obstruction, patients frequently less than forty years of age, melena if the lesion is gastric, and radiosensitivity. However, lymphosarcoma may produce almost any gastrointestinal symptoms. These depend on the character of the growth. Rectal lesions are revealed by blood in the stools and almost always can be palpated. About half of the patients having lymphosarcoma of the rectum have palpable inguinal nodes.

Roentgenologic findings indicate a tumor in which ulceration may be seen. There may be large rugae with separation of folds. Duodenal involvement may be characterized by ulceration with or without spasm. Possible findings of intestinal involvement may include obstruction, destruction, intussusception, polypoid tumors, or chronic obstruction with decreasing motility. Less frequently there is dilatation in the region of the tumor which many hold to be diagnostic of lymphosarcoma.

The case reported is that of a man forty years old who had an acute abdominal condition that was correctly diagnosed as a perforated viscus. Four months later the true lesion manifested itself and pathologic diagnosis proved it to be lymphosarcoma of the duodenum with perforation. Response to radiation therapy was not typical. This case illustrates that if a patient is forty years of age or less, with gastrointestinal symptoms, particularly bleeding, or with lymphadenopathy, the presence of lymphosarcoma should be considered and biopsy of perforating lesions should be performed, abdominal tumors should be explored and pathologic findings should be verified. Treatment varies according to the prognosis of these lesions. Radiation therapy may be most helpful. Spread of these lesions, unlike that of the usual carcinoma, may be rapid and extensive. Small submucosal tumors should be sought in reducing slight intestinal intussusception.—*C. B. Holman, M.D.*

Gutmann, R. A., *et al.* A case of gastric cancer of prolonged and obscured development. *Arch. d. mal. de l'app. digestif.*, Jan.–Feb., 1948, *37*, 109–111.

The case reported is that of a woman, aged sixty-nine, with a twelve year history of gastric complaints attributed to peptic ulcer, who in the last six months experienced progressive vomiting and weight loss.

Roentgen examination showed a constant deformity on the lesser curvature of the stomach. At operation a gastric carcinoma was found extending to the cardia.

An attempt was made to establish whether the lesion represented malignant degeneration of an originally benign gastric ulcer or whether it was a slowly growing carcinoma from the start. It was learned that six years previously, during World War II, the patient was operated upon for bilateral ovarian tumors. Because of the unsettled conditions at that time the pathological report was mislaid and not seen by the attending physician. When found during this present investigation the report revealed that the ovarian tumor had been of the Krukenberg's type.—*J. Lipsay, M.D.*

Justin-Besancon, J., *et al.* Incipient cancer of the pylorus of microscopic dimensions. *Arch. d. mal. de l'app. digestif.*, Jan.–Feb., 1948, *37*, 114–119.

The authors report an interesting case of a woman with a one year history of progressive postprandial epigastric pain, anorexia and marked weight loss.

Roentgen examination revealed considerable

gastric distention and marked stenosis of the pyloric segment.

Due to failure to respond to intensive medical treatment, an operation was performed and revealed two benign ulcers on the vertical portion of the lesser curvature of the stomach and an indurated juxtapyloric nodule. Sections of the latter showed this to be an epithelioma, 5 mm. in diameter, well encapsulated in the muscularis mucosae and submucosa. It was composed of branching pseudoglandular epithelial columns becoming more irregular toward the periphery where cellular atypism was encountered. The adjacent lymphatics were occluded.

The author emphasizes the following features: (1) Multiplicity of gastric lesions; (2) co-existence of benign and malignant gastric lesions; (3) slow-growing epithelioma of microscopic dimensions without invasion of the mucosal surface and showing progressive malignant transformation.—*J. Lipsay, M.D.*

Cohn, Allen L., and Gold, Rubin L. Prepyloric spasm simulating gastric malignancy. *Gastroenterology*, May, 1948, *10*, 782–791.

Eight cases are reported in which prepyloric spasm had to be differentiated from antral malignancy. Prepyloric or antral spasm can occasionally simulate malignancy. Thorough studies are required to make the differential diagnosis. When a malignant lesion cannot be definitely excluded by all diagnostic aids, exploratory operation is indicated. In some of the cases a malignant ulcer far away from the antrum was found at operation.—*Franz J. Lust, M.D.*

Barclay, A. E., and Bentley, F. H. The vascularization of the human stomach; preliminary note on the shunting effect of trauma. *Brit. J. Radiol.*, Feb., 1949, *22*, 62–67.

Through a series of acute observations and simple but ingenious experiments it has been shown that in the stomach there is a series of arteriovenous anastamoses in the submucous plexus. When these shunts are closed, as in a normal individual or in one in whom the sympathetic nerve supply to this area is blocked, the gastric mucosa is supplied with a normal amount of blood. When these shunts are open, and this condition can be caused by trauma, such as opening the peritoneum or handling th stomach, the blood supply to the small vessels of the mucosa is almost completely shut off.

A short discussion of the important problems on which this work sheds light is presented by Walter C. Alvarez.—*E. F. Lang, M.D.*

Samuel, Eric. Gastric varices. *Brit. J. Radiol.*, Oct., 1948, *21*, 519–522.

Varices of the gastric veins develop frequently from the same causes which produce esophageal varices. Veins in the lower esophagus and gastric fundus normally empty into the splenic vein via the vasa breva and the left gastro-epiploic vein. With portal obstruction, first the gastric fundal veins, then those of the lower esophagus, and then even those in the cervical esophagus may become engorged in that order.

In the present series, the veins were best demonstrated during mucosal relief studies, particularly when air in the fundus formed a natural double contrast. They were best shown in the supine left oblique position, or when the patient was upright. The varices appear as polypoid enlargement of the mucosal folds, with more continuity of the folds than normal, and are seen best near the cardioesophageal junction or on the greater curvature. In places the appearance was that of bubbles on the mucosa. Confirmatory evidence is demonstration of an enlarged spleen or of esophageal varices.—*E. F. Lang, M.D.*

Steiner, G. Some aspects of mucosal pattern in the diagnostic study of carcinoma of the stomach. *Brit. J. Radiol.*, Jan., 1949, *22*, 25–32.

An attempt is made to summarize the changes in the mucosal relief pattern encountered in gastric carcinoma and to differentiate those of non-malignant diseases of the stomach. Nine varieties of change, as seen in detail films taken during graded compression of the barium-filled stomach, are listed. (1) The rugal pattern is blotted out by stretching of the mucosa over an elevated infiltration, or with the mucosa destroyed, by protrusion of a smooth-surfaced tumor. (2) Coarse barium-filled crevices of different caliber and irregular course differ from the smoothly curved troughs between the crests of normal mucosa. (3) The "clodded soil" appearance is typical of the superficially ulcerated infiltration and represents barium adherent to cracks or pits on the rough surface of the lesion. (4) Secondary penetrating ulcerations, seen as barium-filled areas in a filling defect. (5) Rigidity and thickening

of the rugae may be less pronounced than in diffuse hyperplastic gastritis. A superficial type of carcinoma, however, can be distinguished by the greater degree of irregularity of the rugal architecture and areas devoid of a mucosal pattern. (6) A sudden break in the continuity of the rugal pattern occurs particularly at the elevated edge of an ulcerated tumor. (7) The spread or crowding of rugal folds in an infiltrated area is found in malignant and inflammatory processes. The presence of other signs of malignancy aid in the evaluation of this sign. (8) A solitary ulcer crater of irregular contour is occasionally the main feature of a gastric neoplasm. Radial convergence of mucosal folds and a "halo" due to inflammatory edema about the ulcer are more characteristic of a benign gastric ulcer. (9) Intraluminal masses of lobulated character are usually carcinoma, but myomas, neurofibromas, etc., though usually smooth, may be lobulated.

Numerous cases exhibiting the mucosal alterations described are presented briefly. The author states that these finer mucosal changes aid in the early diagnosis of gastric carcinoma, but also make the differential diagnosis between benign and malignant lesions more difficult in some cases.—*Harold Fulton, M.D.*

Porter, H. W., and Clanan, Z. B. A Preliminary report on the advantages of a small stoma in partial gastrectomy for ulcer. *Ann. Surg.*, April, 1949, *129*, 417–428.

The authors in a careful analysis of 118 cases of partial gastrectomy for ulcer present convincing evidence of the advantages of a small stoma. They employ the Hofmeister-Finsterer type of gastrectomy and made a stoma 2.5 cm. in length. The advantages are listed as: (1) decreased incidence of leakage of the duodenal stump and anastomosis, (2) marked reduction of postoperative hemorrhage with no case of serious homorrhage in this series, (3) increased emptying which averaged fifty-eight minutes as opposed to fifteen to twenty minutes in patient with a full length anastomosis, (4) development of sphincteric-like action of the stoma which aids in the ability to eat full normal diet and prevents jejunitis, and (5) reduces the incidence of the dumping syndrome. In the writers' series there have been no cases of delayed postoperative vomiting or evidence of late stenoses from obstruction of the small stoma.—*T. D. Allison, M. D.*

Landelius, Erick. Results of partial and total gastrectomy in cancer of the stomach. *Acta chir. Scandinav.*, April 30, 1948, *96*, 441–460.

The author tabulates the results of various operations performed for cancer of the stomach between 1929 and 1940. His material comprises 172 cases: 34 per cent of these had only exploratory laparotomies, 16 per cent had gastroenterostomies or similar procedures, 42 per cent had partial resections, and 8 per cent had total gastrectomies.

The immediate mortality was highest in the total gastrectomy group. Approximately one-half of this group died at operation or in the immediate postoperative period. In contrast to this, the primary mortality in the group undergoing partial gastrectomy (Billroth I or Billroth II) was approximately 25 per cent.

The five year survival in the group undergoing Billroth I or Billroth II procedures was 23 per cent and 25 per cent respectively. The five year survivals in the group undergoing total gastrectomy was only 8 per cent. It should be mentioned that these figures were computed on a relatively small number of total cases that underwent surgery prior to the use of antibiotics, and other measures routinely employed at present to lower the operative and postoperative mortality.

Landelius, after a review of the literature, states that the primary mortality of total resection has measurably decreased at present, and that total resection should be carried out in less advanced cases than has hitherto been usual, in order to avoid later recurrences. It this plan is adhered to, the final results of total resection should equal and eventually surpass those of partial resection.—*E. C. Lasser, M.D.*

Dahl, S. Ulcus ventriculi et duodeni bei Kindern. (Stomach and duodenal ulcers in children.) *Acta paediat.*, 1949, *37*, 49–60.

Reports in the literature of ulcers of the stomach in children are rare. The author presents cases to show that ulcers of the stomach are present in both sexes and in all age groups and that ulcers of the duodenum are more common than ulcers of the corpus of the stomach.

Small children are unable to describe their symptomatology, and thus bleeding is often the chief symptom with the dyspeptic picture more in the background. The symptomatology in older children does not differ noticeably from

that in the adult. The course of the ulcer is similar in all age groups, and the author stresses that stomach ulcers in children are more common than is generally realized.—*Joseph Jorgens, M.D.*

Middlemiss, J. H. Radiological diagnosis of intestinal obstruction by means of direct radiography. *Brit. J. Radiol.*, Jan., 1949, *22*, 11–24.

A series of 188 cases of suspected intestinal obstruction were studied roentgenographically and followed up clinically. Of these, only 3 of the preoperative group of 151 cases proved to be of non-mechanical origin, while 31 of the 37 postoperative cases were classified as neurogenic ileus. The relevant features of the structure, function and normal roentgenographic pattern of the small and large bowel are presented. Roentgenographically cases were classified simply as mechanical or adynamic (neurogenic) intestinal obstruction. In mechanical obstruction there is stasis as shown by fluid levels and distention of the bowel proximally. Small bowel obstruction can be determined as being high, mid or low by the position of the affected loops and the character of the bowel wall as evidenced by the pattern of the valvulae conniventes. Large bowel obstructions can usually be localized more exactly, though it is mentioned that the absence of gas below a point in the colon does not necessarily mean a complete obstruction at that point. Negative roentgen findings in suspected cases must also be evaluated carefully as mechanical obstruction may exist without definite roentgen signs.

Adynamic ileus expresses itself roentgenographically as loops of small and large bowel distended with gas to varying degrees and scattered throughout the abdomen in no characteristic pattern. A mechanical obstruction in the colon combined with an incompetent ileocecal valve could produce a pattern which might be confused with paralytic ileus.

Supine and erect films are recommended for the demonstration of intestinal obstruction. Actually a film of the abdomen in the prone position is preferable to that in the supine, but few patients with suspected obstruction can assume the prone attitude. The use of barium by mouth is condemned except as given through a Miller-Abbott type of tube, as described by Golden. If large bowel obstruction is suspected, a barium enema should be administered immediately. The author's cases appropriately illustrate the value and complexity of direct roentgenography in intestinal obstruction.—*Harold Fulton, M.D.*

Brynjulfsen, B. C. Jejunitis acuta; ileitis regionalis acuta. *Acta chir. Scandinav.*, Feb. 28, 1948, *96*, 361–387.

The author analyzes 21 cases of acute jejunitis collected over a period of twelve years. He defines acute jejunitis as a "phlegmonous inflammation located in particular to the upper portion of the small intestine and presenting a pathological-anatomical picture, resembling that of regional ileitis, but seeming clinically to possess a quite different character with regard to malignancy."

The cases are divided into two clinical groups —a severe form which the author terms jejunitis acuta phlegmonosa, and a milder form termed jejunitis acuta simplex. The criteria for clinical differentiation of these groups appear rather uncertain, but there is a marked difference in prognosis. All of the mild cases recovered, while 14 out of 16 of the severe cases terminated fatally.

No definite etiological factor has been discovered. The author concluded from his material that most of the cases are due to an infection from within the intestine with virulent bacteria penetrating the intestinal wall through some break in the mucosa. Pyogenic bacteria were found in most cases.

All of the layers of the intestine were involved, with predilection for the submucosa. Here there was noted enormous edematous thickening, with diffuse cellular infiltration. The cells are mainly polymorphonuclear leukocytes, but there were also lymphocytes, plasma cells, eosinophilic leukocytes and macrophages. Small hemorrhages and fibrin deposits were noted in the mesentery, and lymphangitis and lymphadenitis were commonly found. As a rule, the morbid process diminished as it was traced downward, and, in some cases, normal bowel was noted between areas of involvement. A number of the cases showed a diffuse serofibrinous, and occasionally a frank purulent peritonitis.

In the group with the severe form of the disease, the onset was usually quite acute with colicky pain often noted in the left epigastrium, or at any rate above the umbilicus. Many of the patients exhibited a severe diarrhea, which

changed to partial or complete obstruction. Extreme general exhaustion was felt by the author to be the most constant and distinguishing feature of the cases termed jejunitis acuta phlegmonosa. The tenderness and rigidity throughout the abdomen were usually slight, and out of proportion to the patient's sense of severe illness.

No definite conclusion can be drawn from the laboratory work which appears for the most part to be inadequate. The roentgen findings are those of a high ileus with fluid levels frequently noted.

The milder form of the disease, or jejunitis acuta simplex, differs clinically from the severe form only in degree. As stated, however, the prognosis is markedly different.

So far as treatment is concerned, the author advocates dietetic measures, intestinal decompression, and penicillin. This last-named antibiotic was used in only one case in the "severe" group, and resulted in complete recovery. It seems probable that the prognosis might be vastly different if antibiotic therapy were to be employed in all such cases. Surgical resection is seldom feasible or successful.

The author also discusses 14 cases of acute regional ileitis. He feels that there is much to suggest that the acute form, which ends in rapid recovery is due to an infection from the intestine in the same manner as in acute jejunitis.—*E. C. Lasser, M.D.*

Fick, K. A., and Wolken, A. P. Necrotic jejunitis. *Lancet*, March 26, 1949, *1*, 519–521.

This is the description of what appears to be a new disease whose roentgen features include rigidity of the wall, defects of the mucosa, and formation of gas in the upper jejunum. Because of its frequent acute onset, most of the patients will probably not undergo barium meal roentgenography. However, its importance is such that a brief review of the symptoms would seem to be of value.

Though sometimes there is a short prodromal period, the onset is usually acute with violent pain in the upper abdomen. At the same time, the patient usually suffers from nausea and vomiting. The most striking clinical feature is the circulatory collapse due to toxemia. The patient may die within twenty-four hours after the onset, but those who survive this stage pass either into a condition characterized by enteritis with blood-stained diarrhea or a condition of intestinal obstruction resembling paralytic ileus. The body temperature seldom rises above a 100.4° F.

This is a jejunal disease of high fatality, apparently endemic, which has been increasing in incidence in Northern Germany since 1944. It is thought to be a specific infection to which defects of diet predisposed. Professor J. Zeissler of Hamburg has reported isolation of a new bacterium previously unrecognized. It is an anaerobe belonging to the group *Clostridium welchii* which he has named *Cl. enterotoxicus* or *Cl. welchii* type "F." It forms a powerful toxin. Should further research confirm Zeissler's opinion about this organism, it may prove that necrotic jejunitis is a specific infection whose manifestations depend upon certain other factors such as malnutrition.—*J. S. Summers, M.D.*

Jones, F. Avery, and Paulley, J. W. Intestinal lipodystrophy. *Lancet*, Feb. 5, 1949, *1*, 214–217.

This is the report of a single case of the relatively rare Whipple's disease which was first reported by Whipple in 1907. Since that time, less than twenty-five reports have appeared in the literature dealing with the same or a similar condition. The cause has not yet been found.

Its interest to the roentgenologist lies in the coarse, irregular mucosal pattern found in the upper small bowel. It must be differentiated from nutritional deficiency states and the sprue syndrome. Other diseases in the differential diagnosis are carcinoma of the pancreas, Addison's disease, and various mesentary lymphadenopathies.

Most patients have been middle aged men and the duration of symptoms before death has usually been one to five years although sometimes much longer. Stabbing central abdominal or epigastric pain has been common at the outset. Fever is not always present and bleeding per rectum when sought for has been more often found than not. A history of arthritis affecting more than one joint has been given by some patients. Increasing lassitude, loss of weight, diarrhea and steatorrhea herald the terminal phase. Brown pigmentation of skin and oral mucosa and hypotension have often suggested Addison's disease. Anemia, achlorhydria, signs of vitamin deficiency, hypoproteinemia, ascites and edema may appear before death.

The present discussion includes a comparison

of the pigmentation noted, to that of Addison's disease. It is suggested that Whipple's disease may possibly originate in a primary nonspecific jejunitis. In the present case, the patient's personality coincided broadly with that found in regional ileitis and in some other intestinal disorders believed to be psychosomatic. The author believes that further exhaustive study of Whipple's disease may shed light on other more common but still obscure forms of steatorrhea.—*J. S. Summers, M. D.*

Holm, Christopher. Intussusception as a complication after appendectomy; report of a case. *Acta chir. Scandinav.*, Feb. 28, 1948, *96*, 308–312.

Primary intussusception of the appendix is not a rare occurrence. On the other hand, there appear to be few reported cases of intussusception as a complication of appendectomy.

The author reports on this complication occurring in a twenty-one year old male on the fourth postoperative day. Previous instances cited in the literature have occurred in cases where the appendicial stump has been invaginated into the cecum. This was not true in the author's case. It is postulated that the exciting cause in this case was a thickened, rigid part of the wall of the mobile cecum.—*E. C. Lasser, M.D.*

Freitheim, Bjarne. Cancer of the colon; survey of the material for the years 1931–1946. *Acta chir. Scandinav.*, Feb. 28, 1948, *96*, 345–360.

The author presents an analytical review of 114 cases of cancer of the colon, exclusive of the rectum, gleaned from case records in his hospital (Drammen) from the year 1931 through 1946.

The greatest percentage of cases (83 per cent) occurred in the age group 50–80 years. For purposes of discussion the material has been divided into two categories, one in which the cancer is located in the right part of the colon to the middle of the transverse colon, and the other in which the cancer is located in the remaining portion of colon down to the rectum. A little more than a third of the cases were situated in the right part of the colon, and a little less than two-thirds in the left part.

Non-characteristic abdominal pains are the most common symptoms of cancer of both sides of the colon. Complete ileus, however, is twice as common in cancer of the left part of the colon. A change in bowel habits, especially constipation, is also a common symptom in cancer of the colon, but is again more frequent on the left side. Constitutional symptoms, such as general malaise, anorexia, and weight loss, are the third most common finding in cancer of the colon, and have a higher incidence in right-sided lesions.

The duration of the past history prior to final diagnosis was less than six months in 79 per cent of the cases. Patients with a short history did not show any higher rate of operability than those with longer histories.

Abdominal tumors were palpated in slightly less than half of the cases, and four times more frequently on the right than on the left.

A summary of the laboratory findings indicates that predominantly, or constantly positive benzidine reactions were found in stool specimens of 80 per cent of the cases. Hemoglobin values were decreased in 54 per cent of cases, with grave anemia occurring more frequently in right-sided lesions. Only 25 per cent of the patients showed a normal sedimentation rate.

Twenty-three per cent of the patients in this series had only exploratory laparotomies or were not operated upon. Eighteen per cent had palliative operations, and 59 per cent had radical operations. Of this latter group the operative mortality rate was 16 per cent, with a five year survival rate of 25 per cent in cancer of the right colon, and 59 per cent in cancer of the left colon.—E. C. Lasser, M.D.

Levene, Geroge. A new method for the roentgenologic study of the rectum. *Surgery*, Jan., 1949, *25*, 68–75.

The author describes an apparatus with which the mucosal surface of the rectum may be sprayed with a suspension of barium sulfate and water. It consists of a metal tip $\frac{1}{2}$ inch long and $\frac{1}{4}$ inch in diameter. A mist of barium sulfate suspension is propelled through a central orifice 1/100 inch in diameter. Two ducts communicate with this orifice, one leading from a syringe containing 10 cc. of the opaque medium and another leading from a tank of oxygen. There is a reduction valve set at 2 pounds pressure on this latter duct. Two large orifices permit compressed gas to escape through a tube out of the rectum. Compression of the

tubes by the anal sphincter is prevented by a helical spring surrounding these ducts.

After thorough cleansing of the bowel, the patient assumes the knee-shoulder position on the roentgenoscopic table and the tip of the apparatus is introduced well into the sigmoid. The patient then takes the prone position. The head of the table is lowered and the suspension is sprayed using a pressure of 0.6 ounce. Spraying is continued as the tip is slowly withdrawn and presents externally. Stereoscopic anteroposterior, posteroanterior and lateral roentgenograms are made.

The advantage of the spray technique is said to be that of visualizing the rectal mucosa and its structures in their physiologic states. This is said to be particularly useful in detecting ulcerative lesions of the valves of Houston.

The method was used in studies of 100 patients. Abstracts of 5 cases together with the roentgenograms are included.—*C. B. Holman, M.D.*

Jemerin. E. E. Cholecystitis emphysematosa. *Surgery*, Feb., 1949, *25*, 237–250.

A case of cholecystitis emphysematosa is reported and a review of the literature on the subject is presented together with a rather extensive discussion of its bacteriology, pathology, roentgenologic features, diagnosis, differential diagnosis and treatment. Although only 14 cases of this disease have been reported since Stolz reported the first ones in 1901, it is probable that the condition is not rare.

In the case reported by Jemerin, the patient was an acutely ill, febrile, obese and blind Negro woman, aged sixty-eight, who had diabetes mellitus and hypertension. She complained of severe pain in the right upper quadrant of the abdomen. A diagnosis of acute cholecystitis with pericholecystitis and possible hydrops or empyema was made, but because of her poor condition, uncertain cardiac status and uncontrolled diabetes she was initially put under medical management.

On the second day after the patient's admission to the hospital, the gallbladder and proximal portion of the cystic duct were visualized roentgenographically as a pear-shaped gaseous shadow surrounded by a circumferential ring representing gas within the wall. Two days later, gas in the pericholic region had increased and the entire cystic duct could be visualized. The patient improved enough to permit abdominal laparotomy and cholecystectomy fourteen days after her admission to the hospital. As the stomach was separated from the right lobe of the liver to which it was adherent, a gush of gas under pressure was encountered. Bile stained pus and gallstones, one of which was impacted in the cystic duct, were recovered. *Clostridium oedematiens* was obtained in pure culture from the pus. The patient improved until the tenth postoperative day when she had a sudden chill and a temperature of 104.4° F. Blood culture was positive for *Escherichia coli*. Although treatment was continued and her temperature became normal in two days, she had a convulsion which left signs of a cerebral vascular accident. Oliguria developed together with a loss of control of the diabetes, and the patient died on the twenty-fourth postoperative day.

No evidence of infection of the abdominal wall was found at necropsy, and death was attributed to a cerebrovascular accident.

Cholecystitis emphysematosa is an acute cholecystitis due to gas-producing organisms with resultant accumulation of gas within the wall and lumen of the gallbladder. The gas frequently extends into the pericholecystic region. The significant incidence of clostridial infection of the gallbladder is unrecognized because bacteriological studies are not made routinely. Acute infection of the gallbladder is usually considered to be secondary to obstruction of the cystic duct. Although the bacteriologic statistics vary considerably with different investigators, a high percentage of all diseased gallbladders are infected and there is a larger percentage of positive cultures obtained from the walls of the gallbladder than from their fluid contents. The most common organisms encountered are the streptococcus, *Escherichia coli*, and the staphylococcus. The incidence of gas-forming anaerobes is uncertain. Although *Escherichia coli* is more common than *Clostridium welchii*, it is not likely to produce gas because of the lack of oxygen. Regardless of the avenue of spread, *Clostridium welchii* would not be expected to be an uncommon cause of infection of the gallbladder because it is a normal inhabitant of the bowel. Growth of *Clostridium perfringens* depends on local injury of tissue which in turn usually depends upon the presence of stones which produce tissue anoxia by ulceration, obstruction or vascular occlusion.

Gas found in infected gallbladders is almost always produced by organisms of the *Clostridium* group. Usually, no gas may be seen roentgenologically during the first twenty-four hours. Later, the dark pear-shaped shadow of gas appears outlining the usually overdistended gallbladder with its wall demarcated by a darker circumferential shadow due to the contained gas. A fluid level is to be expected in roentgenograms made with the film in the upright position. This condition must be distinguished from the much more common fistulous communication with the gastrointestinal tract. In the latter condition air is usually present in the biliary tract, the gallbladder is usually not overdistended, and a dense ring representing gas within the gallbladder wall is not present. Lipomatosis of the gallbladder wall may cast a circumferential ring shadow but there is absence of gas within the lumen.

For treatment, the author recommends operation in conjunction with proper medical measures to combat the infection.—*C. B. Holman, M.D.*

Caminha, Nicola C. Cálculos biliares com núcleo gasoso. (Biliary calculi with gaseous nucleus.) *Rev. brasil de gastroenterol.*, March-April, 1949, *1*, 124–134.

After a brief discussion of the various possible shadows that one encounters in the roentgen examination of cholelithiasis and a review of the literature, the author reports 12 cases of gallstones with gaseous nuclei. It thus seems that this condition is more common than one would expect from the rarity of the cases reported in the literature.

The roentgenograms in all cases are reproduced to illustrate the radiolucencies observed within the boundaries of the gallstones. In the majority of instances they were star-shaped, but other forms were also noted.

The gas consists of a mixture of oxygen, carbon dioxide and nitrogen, usually occurring in the infected or mixed stones. It is probable that the decomposition of organic material by the bacteria is responsible for its formation. According to another theory the gas may be the direct product of aerogenic bacteria. Owing to the low atomic weight of the composing elements, the gas leads to areas of increased radiolucency which may be visible in the simple roentgenograms and show up especially well following the administration of the dye.—*T. Leucutia, M.D.*

MISCELLANEOUS

Henshaw, P. S., Snider, R. S., and Riley, E. F. Aberrant tissue developments in rats exposed to beta rays. *Radiology*, March, 1949, *52*, 401–415.

This important paper relates the biological late effects in Sprague-Dawley rats exposed to beta rays of P^{32}. It is a continuation of the problem in which the more immediate (or acute) effects were reported earlier in the MDDC Reports, which are not generally available. The same group of Sprague-Dawley rats in which the acute effects were reported were further observed for as long as nineteen months and the late manifestations reported as displaying "remarkable malignant activity and developmental abnormalities."

The experimental method is worthy of perusal of those interested in investigative techniques and, briefly, consisted of P^{32}, the beta-ray source, utilized in plastic plagues to line exposure treatment boxes, and also a tunnel-like box through which animals in mesh cages could be transported by means of a continuously moving belt. In this manner two groups of animals were exposed to different types of radiation, that is, single massive dose treatments and small fractionated daily doses.

The results of these experiments showed that following whole body exposures to 400 rep. or above, acute changes began to appear at one week, depending upon size of dose. The manifestations were, first, exudate in the eyes, then skin erythema; followed by wet desquamation, loss of hair and ulcer formation. Death, when it occurred, ensued in about four weeks. In the surviving animals the ulcers healed with skin distortions and various types of failure and dysfunction. In the skin, atrophy, sparseness of hair, telangectasia and neoplastic growths appeared. Malignancies also occurred in the subcutaneous tissue. Loss of external ears and corneal opacities were also found. The neoplasias were of almost every type that can arise from skin and connective tissues, showing a high degree of differentiation; most could be classified as basal and squamous cell carcinomas. Interesting observations of non-malignant developmental abnormalities in toes with accessory claws, horn-like projections, and soft tissue extension of foot pads which were thought to represent intermediate stages between developmental abnormalities and the more advanced malignant lesions were also found.

In the animals exposed to small daily doses of 625 rep. per day the responses were similar to those found in the single massive exposure except that they appeared more slowly and there was no recovery. Those receiving 0.5, 5.0 and 50 rep. per day behaved essentially the same as controls except for the higher tumor frequency in the 50 rep. group.

Subcutaneous tumors occurred in more than half of female controls, but in control males only rarely. Treatment increased the incidence in females by only a few per cent but in males many times, suggesting some significant relationship of sex, but no good explanation is tenable at present.

The optimal single dose treatment for tumor induction appeared to be in range of 4,000 to 6,000 rep., and in repeated treatments 50 rep. per day.

The authors conclude that the radiation, as applied, was able to impel cells destined for a particular pattern of growth and development to change and enter into new channels of behavior.

Two charts, one table, twelve photographs, and thirty photomicrographs were presented.—*Herbert D. Kerman, M.D.*

Gross, Ludwik. The "vertical epidemic" of mammary carcinoma in mice; its possible implications for the problem of cancer in general. *Surg., Gynec. & Obst.*, March, 1949, *88*, 295–308.

Mammary carcinoma of mice, a disease essentially similar to breast cancer of women, is caused by a filterable agent, which is transmitted from one generation to another through the milk of nursing females. This agent can be destroyed by heating to 61° C. for thirty minutes, i.e., it would not resist pasteurization. The agent has antigenic properties, and can be neutralized in vitro by a specific immune serum.

The development of mammary carcinoma in mice can be prevented by the simple method of isolating the newly born animals from their potentially cancerous mothers and by transferring them for the purpose of nursing to female mice whose milk is free from the tumor agent.

Mice of either pedigreed inbred lines or offspring of promiscuous breeding can be infected in infancy by ingesting the mammary carcinoma agent. They remain in perfect health through their early adult life. Upon reaching one to one and a half years of age, however, they develop mammary carcinomas. In the meantime, they have transferred the tumor agent to their own offspring and have thus assured the continuation of the disease in the next group of hosts.

Thus, a female mouse which is nursing is in perfect health at the time she is actually infecting her offspring with the tumor agent. The only indication suggesting that she harbors and discharges the tumor virus is her record showing that mammary carcinomas developed in her female ancestors.

These observations suggest that mammary carcinoma is not a "spontaneous" disease. The law of obligate communicability long established for other infection diseases appears to be valid also for breast cancer of mice.

The possibility is discussed that mammary cancer of other mammals, including man, may also be caused by agents similar to that responsible for mouse mammary carcinoma. If this assumption is correct, women who have a family history of tumors should not nurse their babies; artificial feeding, or feeding with pasteurized human milk should be substituted. This simple preventive measure may interrupt the flow of the virus and eradicate human breast cancer within one generation; breast nursing could then be resumed.—*Mary Frances Vastine, M.D.*

Cowing, Russell F., and Spalding, Charles K. Photographic effect of various radiations on special dental packets. *Radiology*, March, 1949, *52*, 423–427.

This study found special dental film sensitive to exposure of 0-3 roentgens the most useful. The amount of darkening depends upon the intensity and quality of the radiation. The longer wavelength produces more darkening than equal intensity of shorter wavelength. An accompanying graph illustrates this point. The quantities of the materials used and methods of measurement are given in detail. Also various factors which would affect the amount of darkening of the film are presented, such as over and under development, etc.

The conclusion is that in using monitor film, a set of curves for various radiations should be compiled. Measurement of radiation within 15 per cent would then be possible by means of photographic film.—*Gabriel Whiteman, M.D.*

Day, Frank H., and Taylor, Lauriston S. Absorption of x-rays in air. *Radiology*, Feb., 1949, *52*, 239–247.

With the high-intensity output of soft roentgen rays from beryllium-window roentgen tubes, air-absorption corrections are necessary when distance is a factor in roentgen-ray exposure measurements. For example, when the inverse-square law is used to compute the exposure at a point other than where the actual measurement was made.

Roentgen-ray intensity was reduced by 50 cm. of air-absorption to 38 per cent for 7.5 kv. roentgen rays; to approximately 95.5 per cent for 100 kv. roentgen rays filtered by 0.5 mm of aluminum; and to approximately 98.53 per cent for 180–200 kv. roentgen rays filtered by 0.2 mm. of copper (in each instance the beam came from a tube with an inherent filtration of 1.5 mm of beryllium).

The original article must be consulted for the many data on the reduction of roentgen-ray intensity by air-absorption and for remarks on the calibration of thimble chambers for soft roentgen rays.—*Henry G. Moehring, M.D.*

Sisson, Merrell A. A rapid cassette changer for angiocardiography. *Radiology*, March, 1949, *52*, 419–422.

This simple cassette changer, by which 11 by 14 inch films can be taken at the rate of one per second or faster, consists of three main parts: a tunnel in line with the roentgen tube, a lever mechanism by which the incoming cassette ejects the exposed cassette and is arrested in the tunnel, and an approach board for the unexposed films. Lead shields on either side of the tunnel protect the films and personnel. The two radiologists necessary for the operation of the machine do not receive sufficient protection, however, if more than four angiocardiograms are done per day.

In the accompanying photographs and diagrams the construction and mode of operation of this new device are well illustrated.—*Gabriel Whiteman, M.D.*